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Twenty-eight-inch Drill Press.

The accompanying cut represents a 28″ upright drill press built by P. Blaisdell & Co., Worcester, Mass.

This machine will drill to the center of a 28″ circle, which is the diameter of the table. The bed-plate is large, and ribbed to make it rigid. The upper table revolves, so that a piece of work to be drilled can be bolted to the table and a hole drilled anywhere in it within a 28″ radius without loosening the work. The spindle is of steel 1¾″ diameter and will drill a hole 15″ deep. It is fitted with Morse Twist Drill Co.'s number four socket.

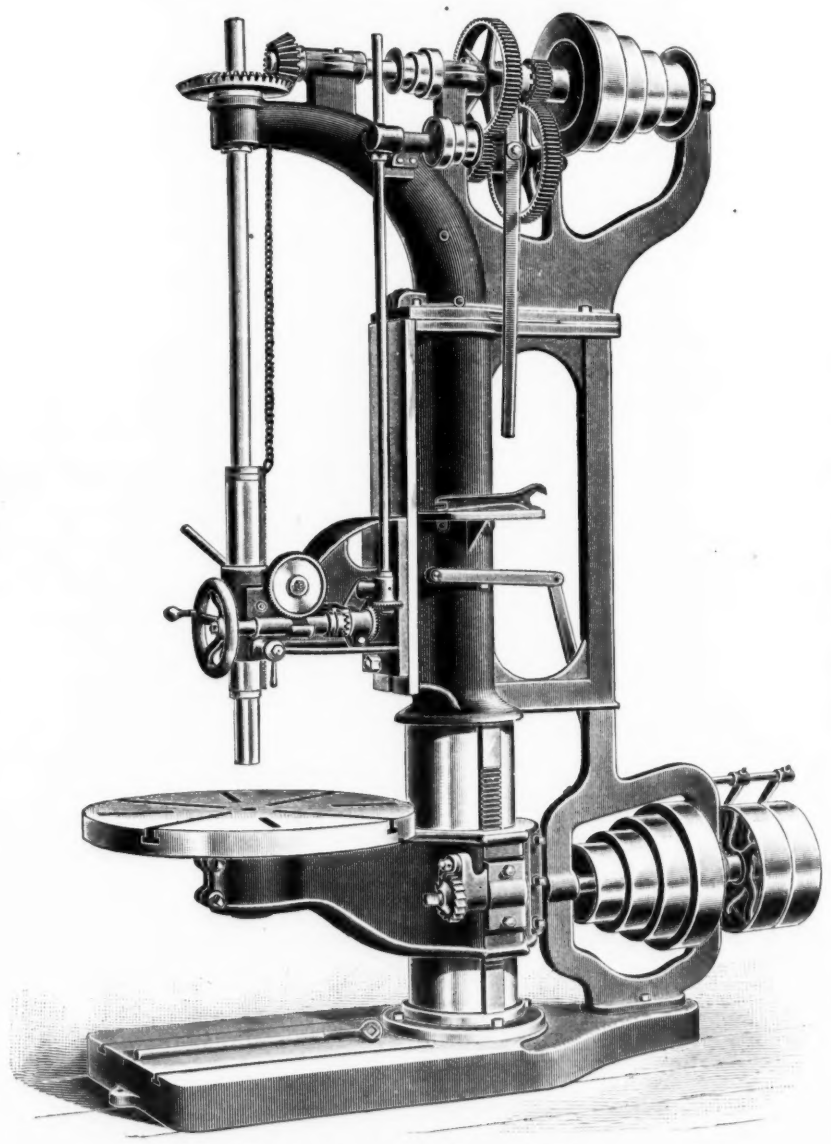
The column at its base is 9½″ diameter. The arm that carries the table is moved up and down with a rack and pinion operated with ratchet wheel and lever.

These drills are fitted with or without back gears. The gears are thrown in or out by a single movement of a lever, and without the necessity for loosening any screws or sliding a nut.

There are three rates of feed operated by belt through a worm and worm gear. The hand feed is connected and disconnected by operating a cam at the front just back of hand-wheel, while the power-feed is connected with a clutch just back of worm-wheel, both of these being operated instantaneously, releasing the spindle so as to run it up or down with the rack pinion operated by the lever on the left side of head. The spindle and head are perfectly balanced separately. The drill head is bolted to the flat face of the column, thus making it rigid without danger of springing the casting.

The shipper for starting and stopping the drill is also within reach of the operator on either side or in front.

The distance from the base plate to the end of spindle when at its highest is 51″; from top of table to end of spindle 36″.



TWENTY-EIGHT-INCH DRILL PRESS.

Practical Details of Die-sinking—II.

BY B. F. SPALDING.

CUTTING THE IMPRESSION.

A former paper essayed to relate some of the steps in getting ready to sink a die. A man may work some time very profitably in getting ready to do most anything and not have very much to show for it.

> "A man must serve his time to ev'ry trade
> Save censure."

In the shop, employers judge of men's work by the amount they can see, and, as yet, all they can see is a dotted line on a steel block, and the workman thinks his line represents length—of time. Let him remember that "Work well begun is half done." An old mover of buildings once said: "When I've got a building well loaded on my rollers I allow that I've got the biggest part of the job done." When the profile of the impression is marked on the block a good beginning has been made. The lines show what stock on the surface is to be removed; they do not show the depth to which it is to be cut away, nor the shape of the bottom. These are sometimes gauged, as the work progresses directly from the model; a better way is to mark off a side view on the side of the die, as it is very convenient to have it there in setting the drills to the right depth.

To illustrate fundamental principles these dies are supposed to be sunk with very simple tools, but not altogether with the simplest. It is fairly to be supposed that any place that requires dies has so simple a machine as a drill press at least.

The simplest tools are those which a Frenchman proposed to use in 1861, when die sinkers were in demand. He was an expert steel stamp cutter whose experience had been exclusively on hand work. In applying for work at sinking forging dies he claimed as a special inducement to give him employment that he did not require any tools except a cold chisel and hammer. It was suggested to him that this accomplishment cut no figure when drill presses were abundantly provided and could displace stock more economically.

"No! no!" he exclaimed, giving his arm a swing as if to strike the blow of a Hercules. "I am strong. I cut a little place deep enough, then I set my chisel back just as much as I can cut, and I cut that chip to the bottom of the hole; then I take another chip; I am not lazy; then I take another—all just so deep—by and by, after a little while, I have the stock all cut out."

The Frenchman's theory was correct, perhaps, although our mechanics would probably cut channels through with a cape chisel, and get rid of half the stock by breaking between the caping, provided they had to "knock a hole into that ere block with a chisel." He made a first-class die-sinker, but he got bravely over his partiality for manual labor after experiencing the benefits of machinery.

Although most of the stock is to be drilled out, it will be necessary to do some chipping. A few good stout bull chisels may be required for heavy cutting. A dozen or more chisels should be provided of various sizes and shapes. After becoming accustomed to them it will be found that it is very handy to use finishing chisels made of about ⅝ octagon steel 7 or 8 inches long, tapered from about 2½″ to quarter of an inch for the size of the head, and from about an inch from that place tapered down to within half an inch of the point where it should be a little less than the size of the cut to which it widens at the point. They are conveniently kept in a tin can on the bench, points up. Some folks are so inherently mathematical that the rule of three dominates all their logic. They insist that if an inch chisel should be 8″ long, then a quarter-inch chisel should be one-quarter as long—4 into 8 two times—hence a quarter-inch chisel should be two inches long. File cutters' chisels are short, but in die-sinking more free-hand work is advisable. If Fig. 5 (page 2) is not a very good representation of the chisel I have described, do not lay all the blame upon the engraver.

"Breaking-through chisels" for bursting out the honeycomb left by the drill are stronger. They may be made of ⅝″ octagon, thinned down back from the point from an inch and a half to two inches, to a little less than the size of the drill which they are to follow. A very good shape is shown in Figs. 6 and 7, which give (6) a plan, and (7) a side view. The use of these chisels in plowing furrows through the stalactic remains after drilling is apparent.

Before proceeding any further it may be advisable to make the trial templates 1, 2, 3, 4, 5, shown in Fig. 8. Templates for trial are sometimes preferred which are made without the overhanging ends which are here shown, and which are designed to rest on the surface of the block, to indicate the proper depth. When they are made without these ends the depth is indicated by a mark drawn across or notches filed in the edges of the templates. Adjustable depth gauges are also almost indispensable in die-sinking; they are made in a variety of forms, according to the taste or notion of the workman.

Some die-sinkers provide themselves with peculiar shaped pieces to fit into places in the dies which they want to smooth up. On those they cut file teeth, and as they are provided with shanks for handles they can be used for smoothing, like files. These tools are called "riffles." Others do this class of work with scrapers. To get a purchase to brace against in scraping, they use a rod which they support with the left hand. They thus avoid the injury which the bracing of the scraper might otherwise inflict upon the edges of the die. The edges are sometimes protected for this purpose by the interposition of a strip of copper or zinc.

The stock which is to be removed from the impression to correspond with the depth template (1), Fig. 8, is semi-cylindrical. It could be bored out either on a drill press or in a lathe. In this case that is not the best way. It is better to drill it out as shown by Figs. 9 and 10. We therefore lay out a central line lengthwise through this part of the die, and draw two series of lines across it at an angle of 60°, which intersect each other and the central line at distances which are a little greater than the size of drill which we decide to use. The points of intersection are center punched, for they are the centers of the holes which are to be drilled. The drill is set as near as may be to the proper depth by the outline of depth marked on the side of the die, and a stop on the drill press is adjusted to gauge it. The lost motion should be taken out of the drill spindle. Ordinary care must be exercised not to drill too deep and to keep within limits, sidewise, as any excess in any direction will necessitate planing off the dies.

The form of the impression at the end of the large part, gauged by template (2) suggests that if the die was strapped on the face plate of a lathe in the proper position, the impression might easily be formed with a turning tool, or that it might be readily made on the drill press with a boring tool like a counterbore or end milling cutter, and the half round shape of the other and smaller end of the impression suggests that the same means might be adopted to sink that also, and there being so much of that kind of work to do on the dies it would be eco-

nomical to make a lathe job of it, and so they might be sent to the lathe. The proposition is very tempting, and under favorable circumstances might be accepted, but really it is not any more difficult to make those parts of the die by drilling and chipping than it would be if their form were not so well adapted to be made by boring or turning, and the trouble of making arrangements for doing it in the lathe or special tools for boring it on the drill press might not be compensated for by increased facility or perfection. We will therefore lay it out and drill it as we did the first part. We will lay out and drill at this time all of the die which is to be sunk to a uniform depth. Afterward we will lay out a row of holes at the proper distance from the edge of the rounded part of the die which is to be sunk to template (3). This rounded part starts in at *A* and runs to the dotted line shown through the template, and setting the drill to the depth near *A* it can be kept at that depth at an equal distance from the profile line around to the dotted line, and then a new series of holes of a different depth from these, but uniform with each other, can be drilled on a parallel line with these, and so on until this section which has a bottom of unequal depth has been duly drilled.

The work of the breaking-out chisel is now in order, and the labor of five minutes at this stage of the proceedings makes a better show than at any other time. The honeycomb is quickly knocked out and a ragged-looking hole appears. Giving the edges a skelp with a bull chisel all around reduces the profile to smoothness and prepares the way for the really good work on the die to commence. This consists in cutting the upper part exactly to the profile as delineated on the surface; in following down from the surface outline at the exact angle which has been determined upon for the draft in getting the bottom of the proper shape, and in getting the corners, where the sides meet the bottom, into true and regular form. These things are all really difficult to do with a chisel, while with a cutting tool—a revolving cutter—they are done with but little trouble, as they are largely governed by the shape of the tools employed.

If the chisel is not properly used an excessive amount of time will be required to finish up with the scraper. It is astonishing how fast a workman improves in close chipping by practice, but it need not be, when we reflect that a good deal of ornamental engraving is done by foreign workmen, mostly with tools which they impel with light hammers.

Good sharp chisels can only be kept sharp by having them made of the best material, so that they will stand to be left hard enough not to lose their edge by battering. To do close chipping requires an edge that is keen, and that will remain so—one that will not slink away from its grip, but will carry the chip clear through.

In finishing up the lower corners some die-sinkers make liberal use of "sets," which are shaped so that one side of the working end rests on the flat bottom of the die, and the other side rises up at the proper angle to give the right inclination to the side. These tools should not be used to such an extent as to cause unequal tension in the die by driving stock down which ought to have been cut away.

"Roughing tools" are useful in bottoming; they are made on a matrix which is simply a mass of square points. By driving the hot roughing tool down on this the end is formed, as though it was a dozen chisel edges crossed with another dozen chisel edges. It is afterwards hardened by driving it down, and moving it about it stamps fine checks, and these are easily rubbed away with file or scraper, leaving a smooth surface.

When the dies are nearly completed, ready for the final finishing, arrangements are made by which a lead cast can be taken when the dies are clamped together as they are to go. If the edges as shown by the lead cast do not correspond they must be altered in the dies until they perfectly match.

The Chesapeake & Ohio Railroad Co. has increased the pay of its firemen 2½ per cent.

The Value of Harvesting Machinery.

The results which have followed in America upon the invention of the self-binding harvester of 1876 are gigantic, and afford a remarkable tribute to the benefits which engineering invention ofttimes confers upon the world. The invention of the apparatus for sheaf-binding and for tying a knot automatically upon the wheat harvester has not only moved any limit upon the production of wheat in the United States, but it is held to have been the most potent agent in enabling the Treasury of the United States to resume specie payment upon a gold basis in the year 1879. Further, that event was one of the incidents which has enabled America to reduce its national debt from its maximum of—in English money—nearly £600,000,000 in 1865 to less than £180,000,000 at the present time. Prior to the year 1877, the American wheat crop had but once exceeded 300,000,000 bushels; the self-binder was perfected in 1876, and was in almost universal use in 1877. Since that time the crop has advanced by leaps and bounds, culminating in the great product of last year, which was 611,780,000 bushels. These are the statements of Mr. Edward Atkinson, of Boston, U. S., made at the recent meeting of the British Association. He also says that since the self-binder was introduced there was no limit to the wheat production of America, except the price. The number of harvesters now made every year in the United States exceeds one hundred thousand. Facts such as these show what can be done and may yet be done in agricultural engineering, and show the importance of new inventions and enterprise. They may also show that we are falling more and more into the habit of relying upon others for wheat.—*The Engineer.*

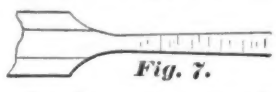


Fig. 7.

Fig. 6.

Fig. 5.

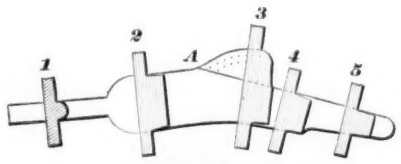


Fig. 8.

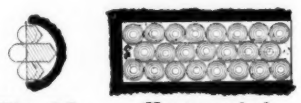


Fig. 10. *Honeycombed* *Fig. 9.*

DIE-SINKING.

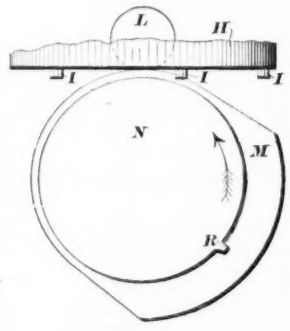


Fig. 2.

On the Cultivation of the Inventive Faculty by the Solution of Constructive Problems.

BY LEICESTER ALLEN.

A considerable number of solutions, and also of attempted solutions that do not appear to meet the requirements of the problem given out in the AMERICAN MACHINIST in issue of July 28, have been forwarded to me by the editor. Without preliminary remark, I will notice first one by Mr. J. T. Slocomb, of Providence, whose former efforts have largely conduced to maintain the interest evinced in these problems.

Figs. 1 and 2 illustrate the method suggested by Mr. Slocomb for effecting the movement specified in the problem, Fig. 2 being a detail showing the shape of the perimeter of the cam *M*, and its relation of position centrically with the wheel *N* and pin-wheel *H*. Mr. Slocomb's description follows:

"*A* is the shaft, and *B* the hub as shown by Mr. Allen, except that I use a flat piece extending clear through the shaft *C*, which piece answers the double purpose of a spline and a means of connecting the hub so as to receive motion from the rod *F*. *E* is a little shoe which is slotted to fit over the flat piece *C*, and is made to turn on the end of the rod *F*. The lower end of the rod *F* carries the truck *L*, which runs in contact with cam *M*, the latter giving the hub the vertical motion. *H* is a pin-wheel keyed to the shaft *A*, which, in combination with the wheel *N* and lug *R*, gives the shaft and hub the intermittent rotary motion. *O* is the driving shaft. *D*, *D*, *D*, *D* are screws holding the flat piece *C* in its place in the hub *B*. *J* is a stand or guide to support the end of the rod *F*.

"In operation, the cam *M* raises the hub *B*, and holds it raised till the lug *R* on the wheel *N* strikes a pin on the wheel *H*. The shaft is then turned till the pin slips off from the lug. Then the cam allows the hub to drop by its own gravity, and when at its lowest position it will remain at rest till the cam gets around again, and the movement will then be repeated in due order, as already described.

"*K* is a friction spring acting as a brake on the wheel *H*, for stopping its horizontal motion quickly.

"I think this kind of a rig can easily be made quite positive in its action, and also independent of gravity or friction, for checking the horizontal movement of *H*, but I have only intended to meet the conditions of the problem as given."

The horizontal movement will not give trouble with low velocity, and so far I have not had occasion to apply a movement of this kind except to a very slowly moving machine. Mr. Slocomb's solution completely solves the problem as I gave it out, that is to say, without any limitation as to whether the motion was to be either slow or rapid. Some who have essayed the solution of the problem think I ought to have stated whether a slow or a swift movement was required. As my purpose was to call out as wide a range of solutions as possible, I omitted any mention of speed.

Another criticism has been made, to the effect that it should have been stated whether, when the hub is raised and after the period of rest required in that position, it must always rotate in the same direction. After reading over the statement of the problem as I gave it out, I see no necessity for this condition. Any solution that clearly meets the conditions as originally given will be accredited and approved, when, in due course, it comes under consideration.

Mr. Adam Gerlock, of Philadelphia, Pa., has sent in the solution illustrated in Fig. 3. It seems rather complicated, but it appears to effect the movements called for in proper order. His explanation is as follows:

"In Fig 3 the pulley *A*, with the handle shown, drives the pulleys *B*. *B* drives the shaft *a*, worm *b*, and gear *c*. *B* also drives pulley *C*, shaft *f*, worm *g*, and clutch *h*, which, when thrown in, drives the bevel gear *i*. The clutch *h* is operated by a cam (not shown) on the back of the worm-wheel *j*. The arms *v v* are held against cams on *j* by springs not shown. The cam *x* on the front of worm-wheel *j* operates the clutch *K*, which alternately revolves the shaft *l* in opposite directions through gears *e e*. The gears *n m* revolve freely on the shaft *l* when not engaged in the clutch *K*, which is splined to shaft *l*. The worm *o* operates the wheel *p*, around which is wound a cord *q*. The cord *q* raises and lowers hub *D*. *D* revolves in loose collars *s s*, to which the cord *q* is attached. The gear *E* drives the shaft *F* and hub *D*. The frame *G* is pinned to shaft *H*, which turns in column *I*. *K* is a box guide for the cam yoke *J*, and turns with the frame *G*. *J* has a rack on the under side, and engages in a fixed gear not shown. During every revolution of the worm-wheel *d*, *J* gives two motions to the frame *G*.

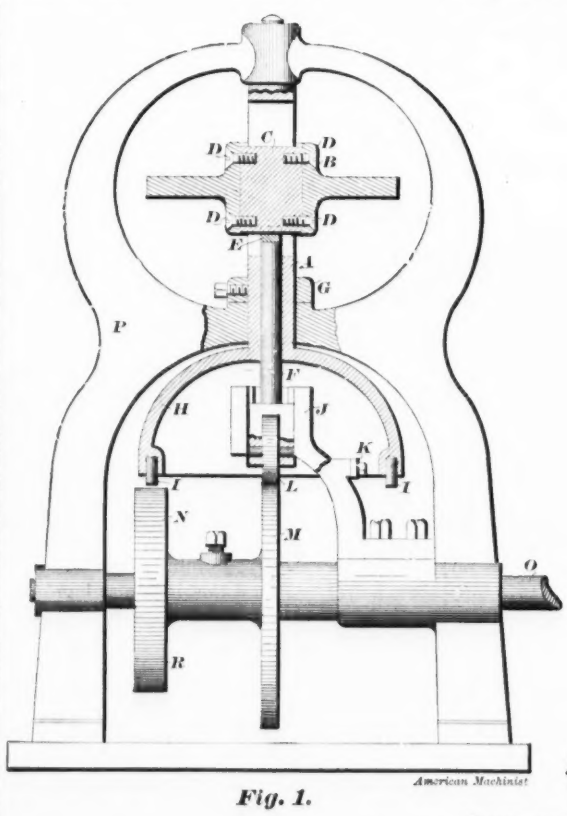


Fig. 1.

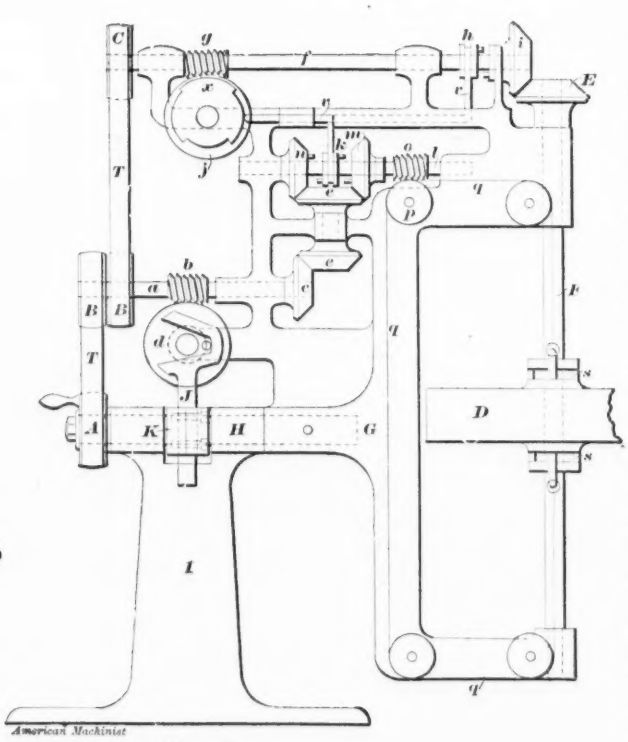


Fig. 3.

CONSTRUCTIVE PROBLEMS.

"From the explanation it will be seen that all the requirements of the problem are accomplished primarily by means of cams, with their accessories. Only the approximate shape of the cams, size of worm-wheels, and proportion of gears are shown. No dimensions or speed are given, as none are required by the conditions of the problem; minor details of other parts are also subject to alteration for the same reason. To avoid slipping of belts *T T*, chains and sprocket wheels may be used instead."

As I gather from Mr. Gerlock's explanation, he has sought to effect a movement beyond that required by the problem, that is to say, a periodical oscillation of all the mechanism attached to the frame on the horizontal shaft *H*. The intermittent horizontal motion of the hub *D*, and its periodical elevation and depression, are accomplished as required without the parts *b*, *d*, *J*, *K*, the rack described and the fixed gear not shown. These seemingly unnecessary parts, however, constitute an ingenious mechanism for the movement intended by the designer.

An extremely simple practical solution, Figs. 4 and 5, has been worked out by Mr. Theo. H. Miller, of Elizabeth, N. J. For simple directness—reaching the desired point by shortest route—this solution is not likely to be surpassed. The principle of the movement is entirely correct, and the only improvement I could suggest would be the supply of friction rollers to the yoke *G*, where it bears upon the cams *E* and *F*, and some positive means of stopping the horizontal rotation of the hub. Mr. Miller gives the concise description of the device quoted below.

"The device consists of two vertical shafts *A* and *B*, upon which are respectively mounted the gear wheels *C* and *D*, which are in mesh with each other. Upon the upper side of the gears *C* and *D* are formed the cams *E* and *F*, which give vertical motion to the yoke *G*, that in turn moves the hub *H* through the collar *I*.

"Below the gear *C*, on the shaft *A*, is keyed an arm *J*, which engages with a six-pointed star wheel keyed to the shaft *B*. Constant motion is given the shaft *A*. The gear *C* being keyed fast, and the gear *D* running loose, a vertical motion is given by the cams to the hub *H* without rotating it.

"The cams are so made as to allow the hub to rest in its lower position for about one-third of a turn of the gear wheels, and in the upper position the remaining portion. Near the end of the upper period of rest, the arm *J* engages with a tooth of the star wheel, and turns the shaft *B* and the hub *H* one-sixth of a turn, after which the hub descends to rest."

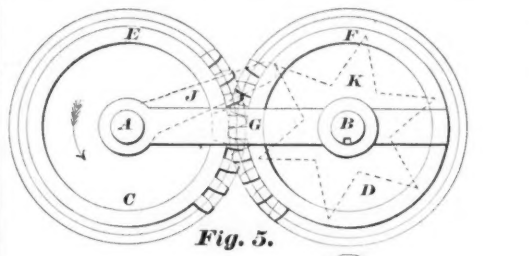


Fig. 5.

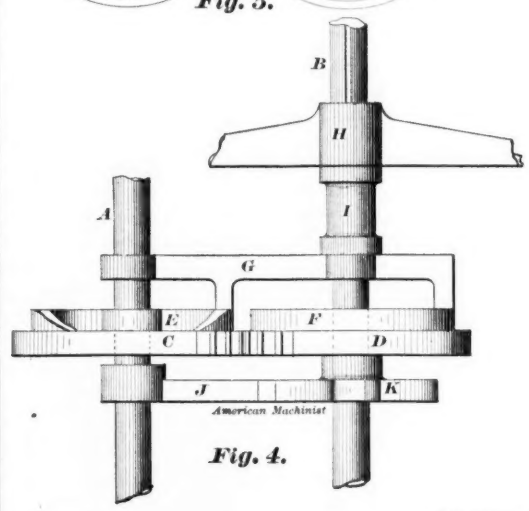


Fig. 4.

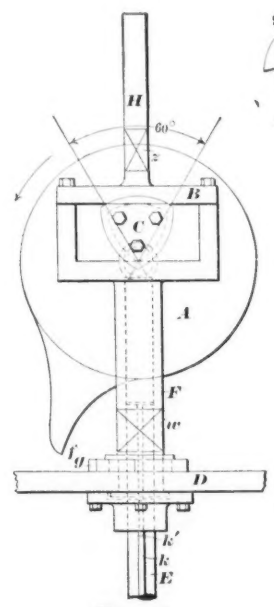


Fig. 6.

Fig. 7.

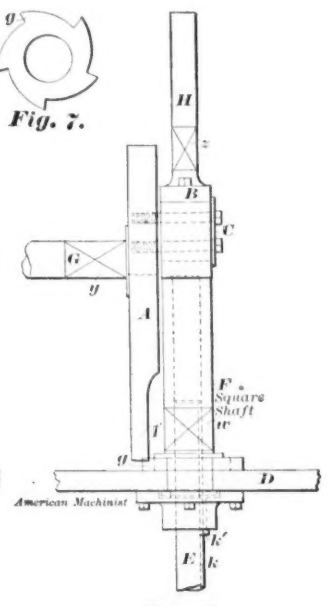


Fig. 8.

The following solution has been sent in by Mr. F. I. Hartwell, of Beloit, Wis.:

"Referring to the Figs. 6, 7 and 8, *A* is the crank disk, *B* a slotted crosshead, *C* a triangular crank-pin, *H* and *F* guides, the latter being square. *D*, with *E*, is free to turn on the shaft *F*. As the crank disk rotates, the shaft *F* is raised and lowered, which raises and lowers *D* and *E*, with a rest at each end of the stroke, lasting while the crank turns through 60°. At the upper end the wheel *D* and shaft *E* are turned through a *fifth* of a revolution, while the crank is turning through about 15°, ending the 60° through which the crank turns without moving the crosshead. The ratchet *g* is so set that the downward stroke begins as soon as the fifth revolution of *D* has been accomplished. A plan of the ratchet (which is made fast to *D*) is shown in Fig. 7. The guides move in bearings at *w* and *z*. A key *K'*, sliding in the keyway *k*, moves the shaft *E* as *D* is rotated by the arm *f* striking the ratchet. I don't think this would be practical if the shaft is to be moved vertically more than a foot, as one corner of the triangular pin must be at the center of the crank disk. Neither would it be practical for high speed, as the arm *f* would strike too hard on the ratchet. As nothing is said about speed or distance through which the shaft is to move, it leaves us to work in the dark, and I am not very well satisfied with my solution."

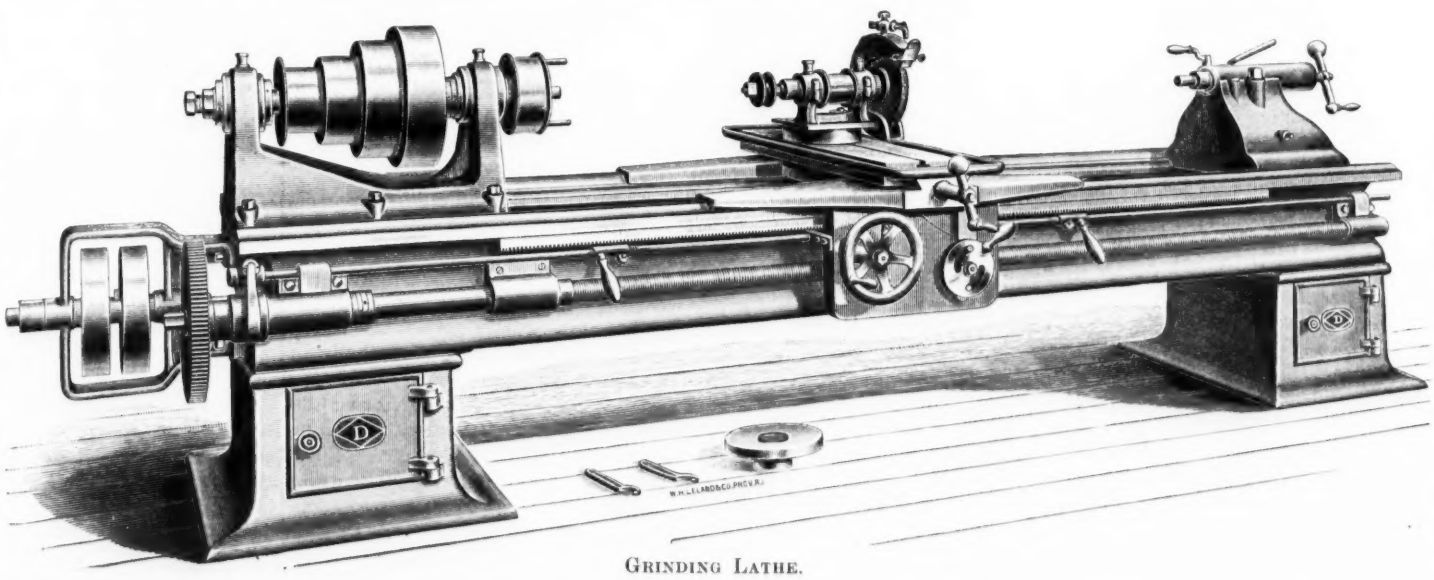
Mr. Hartwell need not fear the criticism he seems to deprecate; the question of best possible mechanism has not so far been involved in these problems, and, as remarked above, there were no restrictions relative to slow or high speeds. Of course, however, those solutions that also comprise best mechanical construction must be considered the best.

CONSTRUCTIVE PROBLEMS.

Grinding Lathe.

We present herewith an illustration of a new grinding lathe which has been brought out by the Diamond Machine Co , of Providence, R. I. Its construction and method of operation will be readily understood from an inspection of the cut, which shows it to be much like the ordinary engine lathe. Back gears are, of course, dispensed with, and there is provision for driving the work upon dead centers by a flanged pulley and driver which is placed upon the spindle in front of the main bearing.

The carriage is moved by a screw, the motion of which is reversed by a shifting clutch operated by a rod which is moved by the carriage coming against adjustable tappets as shown. The carriage has a bearing of 4 feet upon the bed, front and back. It is designed to use a 12" wheel, and if desired can be fitted with automatic cross-feed. As shown, the only way of grinding tapers is by setting over the foot-stock center, but if desired it can be fitted with a swinging platen pivoted at the center of the bed, upon which is mounted the head and foot-stocks. The machine swings over the bed 22", over the carriage 12", and takes between centers 9 feet 6". It takes water from overhead, but can be provided with pump and self contained water system if desired. The bed has water pans for the collection of water which flows from the work, so that it may be used over again. It is provided with a drum overhead for driving the wheel. As shown, the machine weighs 4,000 pounds, but can be made of any desired length or swing.


GRINDING LATHE.

A Fast Run on the C., B. & Q. R. R.

A remarkably fast run was recently made from Galesburg to Chicago on the C., B. &. Q. R R., with their fast train No. 6. The locomotive No. 150 is one of their standard class H moguls, driving wheels 62-inch diameter over the tire, weighing, with tender, 83 tons. The train of 10 cars, including three Pullman sleeping cars and a dining car weighing 357 tons, exclusive of passengers and baggage in the baggage cars.

The distance from Galesburg to Chicago, 162½ miles, was made in 3 hours and 45 minutes, including 7 stops and 4 slow-ups. The actual running time, excluding stops and slow-ups, was 3 hours even, making an average speed of 54 miles per hour. The distance from Mendota to Aurora, 45½ miles, was made in 53½ minutes, including a stop for a railroad crossing. The fastest speed made was at the rate of 73 miles per hour down a grade 36 feet to the mile.

The above particulars are taken from dynamometer car records, and are absolutely reliable. Considering the weight of the train and the distance run, this performance ranks among the fastest runs of the world, and is a splendid attestation of the excellence of the C., B. & Q. class H engines, which, as it is well known, are simple 19 by 24 inch mogul locomotives with Belpaire boilers.—*National Car and Locomotive Builder.*

A Workingmen's Hotel.

The Trades Hotel, soon to be erected on Fifty-fourth street and Woodlawn avenue, two blocks north of Jackson Park, is to be for workingmen, and will be the largest hotel in the city. It will be a solid masonry building, eight stories high, with accommodations for 3,000 guests, and the aim is to have prices so moderate that the humblest laborer can afford to come to the World's Fair. On the payment of $20, a room is to be reserved for two weeks at some time during the fair, with the understanding that the guest will receive a rebate of $5 if he comes during the time assigned by the management. This plan, the directors think, will prevent undue crowding on any particular occasion. The building is to cost about $450,000. Work will be begun Sept. 15, and is to be completed next April. James E. Moore, the furniture man, is president of the Trades Hotel Company. The $500,000 capital stock of the company has all been subscribed.—*Chicago Journal.*

The Utilization of the Power of Ocean Waves.

It is likely that in and around San Francisco more attention has been paid to the derivation of power from ocean waves than in any other place in this country; a combination of circumstances contributing to this. In the first place they have there the waves which are practically continuous, and are close to the city, while the cost of fuel is very high, thereby making the incentive to the discovery of a substitute for fuel all the stronger.

The concluding paragraph of a paper upon this subject presented by Mr. Albert W. Stahl, at the San Francisco meeting of the A. S. M. E., is as follows:

"In conclusion, it may be interesting to note that of the 32 patents which have been granted in this country for the improvements in wave motors, just one-half have been granted to residents of California. This is probably largely due to the high price of coal in this State, which naturally causes men to look favorably on any scheme that seems likely to reduce the cost of power; while another and important reason is to be found in the fact that the ocean waves as they reach this shore are usually much more regular in size from day to day than on the Atlantic coast, thus helping to reduce the

commercial difficulties of the problem. The circumstances are thus, on the whole, considerably more favorable to the success of a wave motor on the Pacific than on the Atlantic coast, as a less degree of efficiency in such wave motor would be required here than there to enable it to successfully compete against coal and the steam engine."

The paper, which is much too long for reproduction here, elicited much interest. In it the recognized theory of ocean waves was quite fully presented, showing that the motion of any given series of particles of water arranged in a vertical line was such that the common mechanical motion most nearly conforming to it would be that of a vane whose center of oscillation should be below the surface of the water and at the bottom of the wave, the top of the vane being at about the top of the usual waves. This, it will be noted, is the reverse of what has been done, the wave motor at Ocean Grove, N. J., for instance, being a vane suspended from above the surface of the water and hanging down into it, thus wasting a considerable portion of the energy of the uppermost portions of the waves—which have most horizontal motion, in moving other parts below, further than the wave action would move them, the resultant motion of the vane being much less than if pivoted at the bottom. The author then showed how it was proposed by himself and Mr. Richard Gateway, U. S. Navy, to utilize the principle, but did not assert that it would certainly be successful, only going so far as to say that he thought, for the reasons given, it had a better chance of success than any previously tried plan.

In the body of the paper the following table is given:

TOTAL ENERGY OF DEEP-SEA WAVES IN TERMS OF HORSE-POWER PER FOOT OF BREADTH.

Ratio of length of waves to height of waves.	Length of Waves in Feet.							
	25	50	75	100	150	200	300	400
50	.04	.23	.64	1.31	3.62	7.43	20.46	42.01
45	.05	.29	.79	1.62	4.47	9.18	25.30	51.94
40	.06	.36	1.00	2.05	5.65	11.59	31.95	65.58
35	.08	.47	1.30	2.68	7.37	15.14	41.72	85.63
30	.12	.64	1.77	3.64	10.02	20.57	56.70	116.38
25	.16	.90	2.49	5.23	14.40	29.56	80.85	167.22
20	.25	1.44	3.96	8.13	21.79	45.98	126.70	260.08
15	.42	2.83	6.97	14.31	39.43	80.94	223.06	457.89
10	.98	5.53	15.24	31.29	86.22	177.00	487.75	1001.25
5	3.30	18.68	51.48	105.68	291.20	597.78	1647.31	3381.60

The above table gives the *total* energy, including both kinetic and potential, inherent in a regular series of waves. The figures are strictly correct for the trochoidal deep sea wave with circular orbits only, though they give a close approximation for any nearly regular series of waves in deep water, and a fair approximation for waves in shallow water.

At the conclusion of the reading of this paper, Mr. Stahl said: I have made in this paper some criticisms of certain other schemes that have been tried, and I understand there are some gentlemen here who are going to have something to say about these schemes, so I want to recapitulate briefly what I consider the objections to all schemes which are types of 99 per cent. of every experiment tried in this direction.

I refer in the first place to floats, and in the second place, to vanes suspended from above.

The objection to the floats is just here, as I see it: the total amount of power that you can get out of a float is, of course, its weight multiplied by the height through which it rises, and that is all there is to it. You can do as has been done in some cases—and patents obtained on the same as valuable improvements—and take part of the power off on the way up and part of it on the way down, the idea being that you get more power. That is absurd. Now, in order to increase the power in a float, you cannot increase the height; all you can do is to increase the weight. If you make the float heavy beyond a certain amount there is a great deal of inertia, so that as the waves come rather fast they will run up the side instead of lifting it bodily, and you don't get the whole lift, and lose efficiency. Another effect of increasing the weight is to increase the depth to which the thing sinks and you soon come into a region of much less lift, the lift decreasing very rapidly with the depth of water.

Now, if you increase the size of your float. Average waves are 100 to 200 feet long, *i. e.*, when there are waves at all, that is about what they will be. From that they run up to 400 or 600 feet, which are storm waves. Now, if you have a float 25 feet square, you are going to get a certain amount of power. Suppose you make the float 200 feet square, you are going to lap over the whole length with that, and if you had it 300 feet square your float would not move, because as the particles are coming up in one place they are coming down in the other place, and you get the average motion, which is zero.

As to the vane suspended from above when it simply touches the surface of the water it will vibrate, and you will get power, without question. There is an arrangement of that kind at Ocean Grove, and it is practically successful; that is, it is not efficient, but it pumps water.

But when you wish to increase the power the natural thing to do is to immerse your vane, and the further you go down the more power you ought to obtain if the thing is constructed on proper principles; but as soon as you do this you lose efficiency, and if you go deep enough you stop.

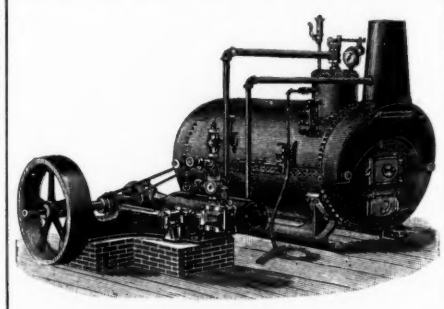
A gentleman called my attention the other day to a thing which illustrates this very nicely—the piles in the slips in the docks; if they are cut off by certain insects at the top near the water line, when the wave is passing you will notice them vibrate a good deal; the upper portion will vibrate back and forth, the lower one being still fixed. There is another insect that cuts them off down at the mud, and they stand still, don't budge. That is a similar case to this vane, which is suspended.

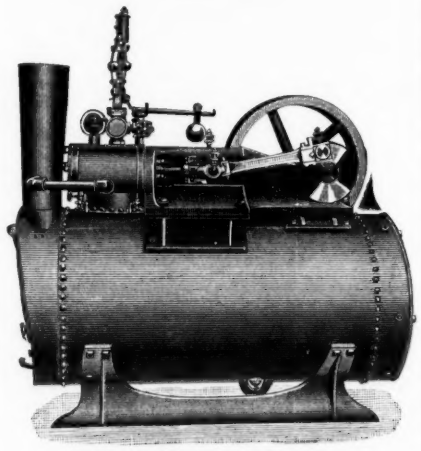
Mr. Dickie commended the paper, especially the table given above, but he wanted to know what could be done practically with this power.

We take a unit of 1,000 horse-power. The capitalization for that at the present price of coal in San Francisco would be about $400,000, that is, any apparatus, in all its connections and in all its applications, that would cost more than $400,000 for the production of 1,000 horse-power would not be admissible for a production of 1,000 horse-power, and it would be exceedingly interesting if the application of this power could have been figured out in such a way as to show the capital required for the production of 1,000 horse power, because thereon hinges the usefulness of such an application of power. Mr. Stahl indicated the storage of power by a reservior. In the application of this power near by the bar of San Francisco harbor, where the waves could be most depended upon, perhaps, an elevation of not more than 200 feet could be counted on. Assuming that 200 feet elevation could be obtained, and that a storage would be required to maintain a constant power and storage of 15,000,000 cubic feet that would be required of sea water, in order to produce that power without any surplus for lack of efficiency, to which 25 per cent. at least should be added for any motor that can be applied. Now, whether all that and the apparatus itself, works to protect it, pipes to convey the water, and motors to distribute 1,000 horse-power could be estab lished for $400,000 would be the question that I think would settle the economic possibilities of a wave motor power. Perhaps there is no place in the world where a wave motor could be so successfully utilized as in the vicinity of this city. We are near the ocean, we have the waves, more than we would like to have, the price of fuel is high, and if wave motors are ever to be used economically and compete with other sources of power, this would be the place for their installation.

MR. MOLERA: I didn't intend to say anything about this subject, but so many gentlemen take interest that I think I will say some words. I happen to have gone through what I believe nearly all engineers have at one time or another; either begun this plan of utilizing wave power, or at least given it some consideration. Of course, we all see in the water an immense power, extended all over the ocean, and the manifestations of which are very grand.

I used to be in the lighthouse department; I was assistant ligh house engineer from 1870 to 1875. All the reasons for trying to apply the wave power to some useful purpose are there very much emphasized. We had to transport coal, which is exceedingly high on this coast, to two points nearly inaccessible, and at double the price of the coal. Then we had to store water in cisterns and make a water shed, as we used to call it, and therefore it was a very expensive way of supplying the power for the whistles along the coast. Under the circumstances I began to think of applying the power, and I went also into floats and into a great many apparatuses





NEW ENGINE AND BOILER.

similar to those Mr. Stahl has described, and another that Mr. Stahl has not described. For instance, I thought of employing a water-tight vessel with appropriate barrels, so that when the water rises the volume diminishes, the air is compressed, and when it gets to a certain density it goes to a proper reservoir, and *vice versa*, when the water falls it rarefies the air. I have devised also an apparatus like a hydraulic ram, where the water passed from one trumpet-like pipe and ended in the other, and when it acquired a certain velocity a valve stopped suddenly, and the ram operated through the valve, etc. I think it is so difficult to devise an apparatus that will convert the wave motion into some other motion that can be applied. I think the apparatus that Mr. Stahl has described to night is exceedingly ingenious. I don't think there is any other, as far as I know, that is as ingenious as that; but, as Mr. Dickie says, when you have got this, what about it? The wave motion is exceedingly unmanageable, and I have found it exceedingly unprofitable; you can depend upon it at certain times only. Mr. Stahl says 10 days must be allowed on this account for storage of water; my own investigation of this from the records convinces me that there may be intervals of 20 days during which no power can be taken from waves. But taking the ten days' limit, and taking Mr. Stahl's figures, any engineer who has the time to find out what it would cost to build, for any kind of a structure, brick or masonry, any kind of a reservoir 30 feet high and 200 feet long—or about that—you will find that the reservoir alone will cost from $15,000 to $20,000. I know of no city so close to the ocean and so favorably situated for storing water in high places as this, but even here there are but two places where it could be stored at an elevation of 300 feet, and these places are so situated that the pipes leading to them would have to be about one mile long.

Then having your water in this reservoir you have to convert its power into some other form for which electricity is probably best adapted. Therefore, you would have to transform the weight of the water into hydraulic power, then into electricity, convey this through a conductor 6 or 7 miles long to the center of the city, and then to small motors for the purpose of utilizing the power, and so on. Having gone through this problem in detail I find it to be impracticable. At first, I was very sanguine, maybe more sanguine than Mr. Stahl. I sent a preliminary report to the Lighthouse Board, and got a very flattering letter, which, of course, I keep as a relic, from Prof. Henry, who is a man of great eminence, and he encouraged me to go on, but when I went into the details of the cost of the thing I recommended that every fog signal station on this coast get a proper boiler and supply of coal and get the power in that manner. If Mr. Stahl can do better than that, of course we shall all be glad—very glad.

In closing, Mr. Stahl said the maximum theoretical efficiency was 50 per cent. of the power given in the table, and what the actual efficiency would be was unknown to him. He did not claim that his device would be commercially successful, but simply that it was the most scientific and more likely to be successful than any other.

New Engine and Boiler.

We illustrate herewith a new engine and boiler, which are designed to be set up in either of the forms shown by the illustrations.

The engine is of the self-contained, side-crank type, conforming in its general design to modern practice.

The cylinder is bolted to the rear of the bed and overhangs, the guides being formed in the solid bed. Heavy brass shoes which are adjustable are attached to the crosshead, and the connecting rod, which is forged, has heavy brass boxes secured by straps and keys. A plain slide valve is used, which is moved through the medium of a rocker arm of substantial construction.

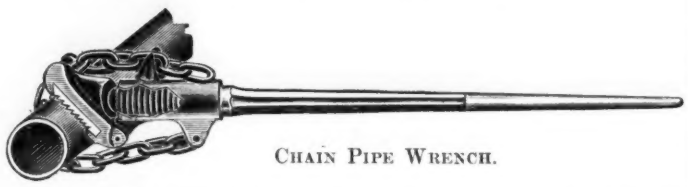
The boiler is of the "Scotch" type, the fire box of tubular form extending clear through near the bottom and entirely below the water line, the heated gases returning through the smaller flues, which are above. The merits of this form of boiler in point of economy and otherwise are well understood, while another advantage gained by its use in this instance comes from the fact that the engine is frequently used where wood is the only available fuel, and it can be used in this fire box in the ordinary lengths of cordwood without the necessity for cutting it up into shorter lengths. The boiler is made of open hearth homogeneous steel of 60,000 pounds tensile strength, and both boiler and engine are of the best materials throughout. They are made in various sizes by the W. C. Leffel Co., Springfield, Ohio.

Gunpowder is a force that acts so quickly that it may be taken for a blow from a sledge-hammer. A fly-wheel was to be removed from the end of a shaft, and, to make the work as light as possible, another wheel from the waste pile was placed alongside of it on the shaft, and a seam charge of powder exploded between these hubs. It is now thought that if a strain could have been brought upon the rim of the wheel by ropes extending in the direction of the shaft, this wheel might have been available for further use. As it was, the hub moved too far for the spokes to spring such a distance without having some assistance from the rim of the wheel.—*Boston Journal of Commerce.*

A New Pipe Wrench.

The accompanying illustration is of a new chain pipe wrench which has been designed to overcome some of the well known defects of the ordinary chain wrench.

The wrench consists essentially of a body which is in the form of a sleeve, to which is attached at its lower side the chain, and also the jaw which is hinged to it as shown. This body is internally threaded and the handle screws into it, passing through and bearing in a socket at the back side of the jaw, as shown. In use the chain is passed about the pipe in the manner shown and hooked over a horn, which is formed upon the upper side of the body. Then by screwing in the handle all the slack can be taken up in the chain and the action of the wrench is such as to give the maximum rotative effect, with the minimum tendency to crush the pipe, while by unscrewing the handle the wrench can always be released so there can be no bothersome locking onto the pipe.



CHAIN PIPE WRENCH.

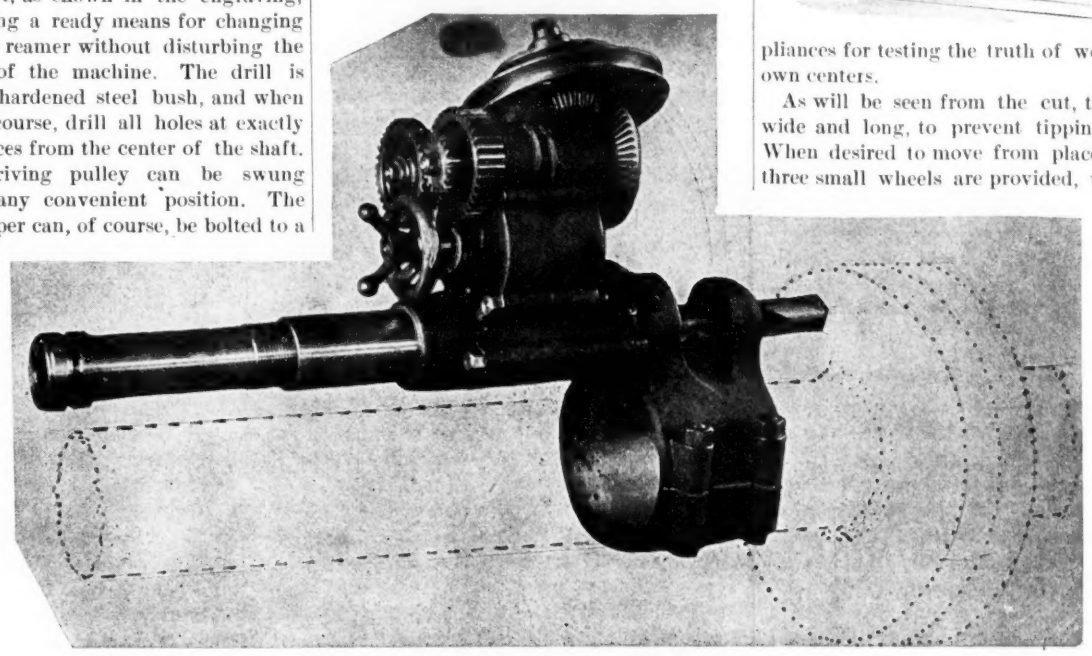
The body and jaw of the wrench are of malleable iron, the latter with steel teeth which are readily renewable; the handle is of steel.

This wrench is claimed to be a very superior tool in many respects, and tests made with it seem to show that this claim is well founded. It is called the "Hilts" wrench, after its inventor, Mr. Geo. S. Hilts, of Groton, N. Y., and is manufactured in six different sizes by the Roll Paper Cutter Co., Richford, N. Y. It may be seen also at the office of Mr. C. Hoffman, Jr., 112 John street, New York City.

Portable Drilling and Reaming Machine.

We present with this an illustration of a portable drilling machine which may be used for a variety of purposes, but is shown as specially adapted to drilling and reaming bolt holes in the couplings of marine engine or other shafts, for which purpose it is necessary only to provide a few clamping pieces of standard sizes to fit the shafts, and these can, of course, be bushed with split sleeves for intermediate sizes.

The machine has ample power and strength for any twist drill within its normal capacity, and they are made for holes from 3″ diameter down. There is an automatic or hand-feed, and the spindle may be removed from the machine by unclamping and drawing out to the left, as shown in the engraving, thus providing a ready means for changing from drill to reamer without disturbing the adjustment of the machine. The drill is guided by a hardened steel bush, and when set, will, of course, drill all holes at exactly equal distances from the center of the shaft. The rope-driving pulley can be swung around to any convenient position. The machine proper can, of course, be bolted to a fixture of any desired form, as well as to the one shown. It is manufactured by James T. Halsey, 26th and Callowhill streets, Philadelphia, Pa.

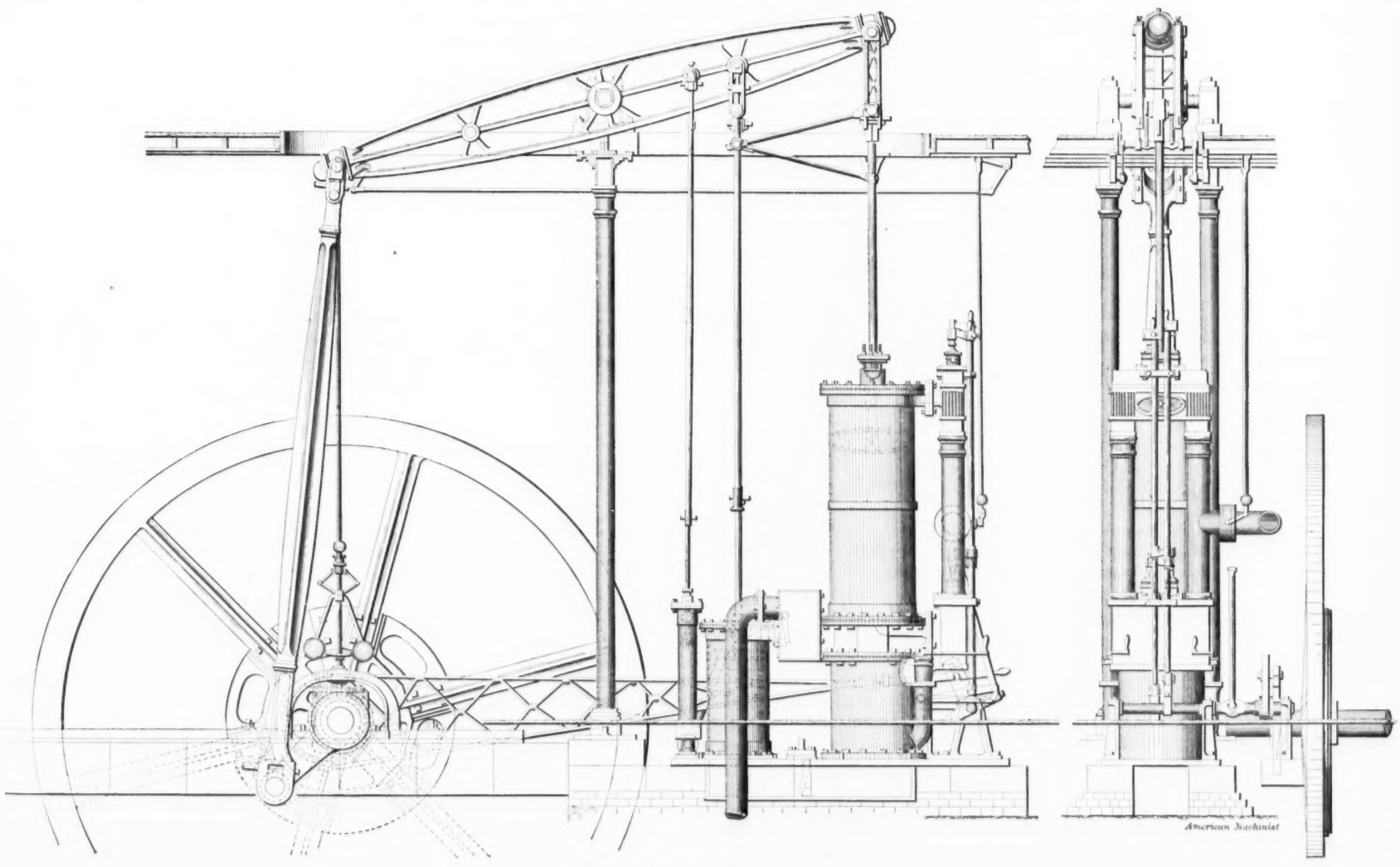


PORTABLE DRILLING AND REAMING MACHINE.

Mr. James Tribe, who has written several articles for the AMERICAN MACHINIST on the compound engine, has accepted a position with the Hoffmann & Billings Mfg. Co., of Milwaukee, Wis., as mechanical engineer, in the steam engine and machinery department.

A Watt Engine in Savannah.

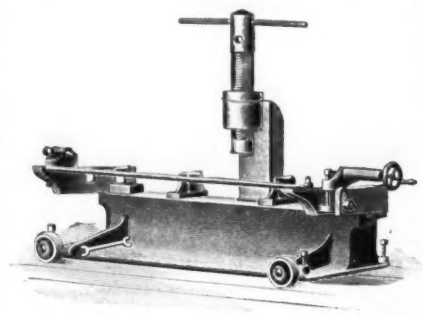
With this we give a side elevation and end view of a 90 horse-power beam engine which will undoubtedly be of great interest to many of our readers, as it is probably the oldest working engine in this country. It was built in 1815 by James Watt, Lancashire, Eng., brought to Savannah, and erected at the rice-mills of Messrs. McAlpin & McInnis. It has been working regularly since, and during the milling season was often run day and night. During August, 1891, it was put in good repair by John Rourke & Son, Novelty Iron Works, Savannah, Ga., to whose kindness we are indebted for blue-print and particulars regarding the engine. The cylinder is 31 inches diameter; stroke of piston, 72 inches; number of revolutions per minute, 18, with 8 pounds steam pressure. It has a common jet condenser and an air-pump 24 inches diameter; the boiler-feed pump is worked from the beam. The crank, shaft and connecting rod are made of cast-iron. Most of readers will probably be surprised to know that there is a Watt engine running in this country.



A WATT ENGINE IN SAVANNAH.

Shaft-straightening Machine.

This machine is designed to furnish a convenient means of straightening shafts, etc., either before or after turning, with appliances for testing the truth of work on its own centers.



As will be seen from the cut, the base is wide and long, to prevent tipping in use. When desired to move from place to place three small wheels are provided, which are found to be steady enough for most work, but to prevent rolling the machine can be raised by means of small jack-screws until the wheels clear the floor, and either three, four or five screws serve as supporting points. Under main screw are four V-blocks adjustable for different lengths of work, and the two outer ones are extended forward to carry a pair of centers adjustable vertically, so a shaft lying on a small groove directly below centers may be picked up in a position

to be freely revolved by one hand, by screwing up the center at the operator's right, which is arranged similar to a lathe foot-stock spindle. After being tested, for which a rest is provided for the operator to steady his hand upon while holding chalk or other marking material in the usual way, the centers are slackened and the work is free to roll in to V-blocks for further straightening if necessary. A pair of small rolls just forward of centers, and lying at right angles to the axis of work, provide a very easy means of shifting the work longitudinally, to bring any desired point under main screw.

These rolls do not show plainly in the cut, on account of lying behind hand-rest, but are 1½" diameter and four inches long. Main screw is 2⅞" diameter, has a bearing five inches long in nut, and short lever for quick adjustment. The machine will take four feet between centers, and is powerful enough to bend shafting four inches in diameter.

It is built by Wm. M. Moore, 1134 Hamilton street, Cleveland, Ohio.

LETTERS FROM PRACTICAL MEN.

Cutting Bevel Gears—A Half-tooth Planer Feed.

Editor American Machinist:

I note with surprise what Mr. Hannum has to say about bevel gears in your issue of Sept. 8, and I think his accusation that mechanics who know anything about cutting bevel gears are either unwilling or unable to impart such information, is entirely unjust. If Mr. H. will refer to my article on the subject in the issue of Feb. 25, 1892, I think he will find an explanation of the process of finding the pitch diameter, addendum, angle at which to turn blank, curvature of cutter, number of times to cut through, avoidance of undercut on high ratios, and the method of setting up the machine to do the cutting. The setting of machine is still further elucidated in the issue of June 23. If this information is not sufficient for Mr. Hannum, it is difficult to perceive what can help him. As to his "cut and try" rule, I do not take any stock in that, when you can get there just as well, and better, in fact, without it. I might add, for Mr. H.'s benefit, that the process I described is good only when the tops and bottoms of the teeth are both parallel with the pitch cone, which, in my opinion, is the only correct way to have them when rotary cutters are used.

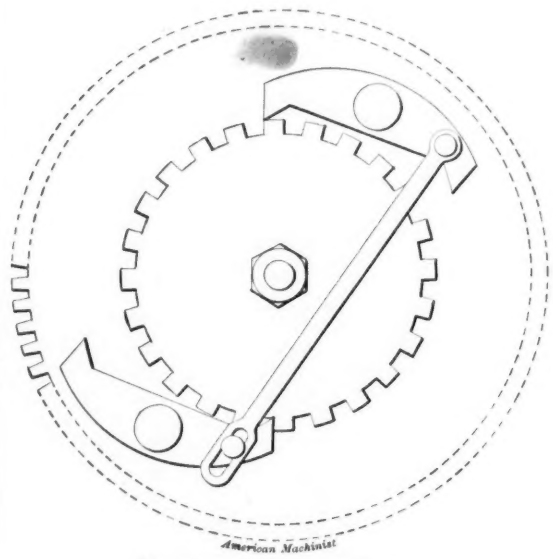
In a shop where I sometimes go to borrow the planer, there is a young man who likes to discuss the merits and shortcomings of various tools, and in talking of planer feeds one day, he told me of a planer he once worked on, in which the vertical power feed was so coarse, when using only one tooth of the feed ratchet, that it was impossible to use it on a parting tool, so he had to cut up a lot of cast-iron plates by feeding down by hand. In a joke, I asked him if he couldn't make the ratchet feed half a tooth, which he said couldn't be done. The discussion took a serious turn again, and we agreed that it could be done by adding an extra feed pawl, located relatively to the original one as shown in sketch. Then if the feed crank was adjusted in its T slot so as to make the rocking plate travel a little less than one tooth, the pawls would act alternately, and accomplish what we at first thought was impossible—a half-tooth feed. This device would also come in where it was desired to feed 1½, 2½, 3½ teeth, etc., and yet by placing one of the pawls in midgear it wouldn't interfere with the other one when feeding 1, 2, 3 or 4 teeth. At the time, I thought this was a brand new idea, but upon making inquiry later, I found it was a matter of ancient history. However, it may prove of interest to a few of your readers. The first idea that occurred to me was to put two narrow pawls on one stud, leaving one longer than the other to the extent of half the circular pitch of the ratchet, but the difficulty of getting on a spring for the outer pawl led to the suggestion of two separate studs. The slotted rod connecting the two pawls is merely to prevent the possibility of attempting a right and left feed at the same time.

WALTER GRIBBEN.

Turret Machines.

Editor American Machinist:

Your editorial in issue of September 8th, regarding the above carelessly thought of shop tools should be read carefully by all owners and managers of machine shops. Having had the good fortune in the past few years to see the inside of nearly two-thirds of the shops of our country, I have noticed how seldom those in charge of the work appreciate the great value of the turret lathe. Like the milling machine, it is not earning one-half



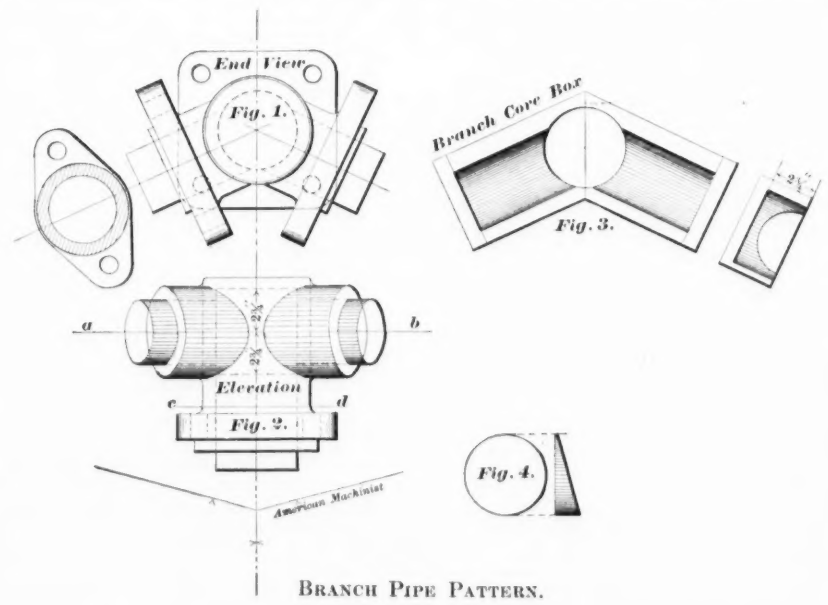
HALF-TOOTH PLANER FEED.

the dividends within its scope, from the simple fact that those in charge and directing the movements of the men, machinery and materials in machine shops are ignorant of its possibilities, and being conscious of that same ignorance, they dare not assume the responsibility of possible failure; thinking probably they would lower themselves in the estimation of their subordinates or employes, while in truth the majority of those subordinates and employes are fully aware of the existing conditions and causes thereof, and silently enjoy all the benefits therefrom. Some one may say: "They are not honest employes." Are they not just as honest as the one who directs their labors, be he owner or manager? Is he not supposed to get all possible interest on money intrusted to his care, and is not the time of those men, and the time it takes to do a piece of work, so many dollars and cents that he is responsible for? And if he is too cowardly or ignorant to introduce and keep up all best methods to produce greatest amount of work at least possible cost, are the men to be censured? There is not a machine shop anywhere, no matter how small, but should have a turret lathe among its shop equipment. If there are but two eighteen inch lathes in the shop, one of them should be a turret, or be furnished with a monitor foot-stock. The turret may not reduce the pay roll in all cases, but it will in the hands of a bright, skillful mechanic, make it possible to increase the business output without increasing the pay roll.

Recently, while being shown through quite a good-sized machine works by one of the firm, I was asked for a suggestion that would better their plant. My answer was, "a turret lathe," and I was pleased to find that they both had the same thought in their own minds, but had not seen any machines doing their class of work, and had always been under the impression that a turret was intended for special lines of manufacture. Looking over their place again carefully we arrived at the conclusion that a good make of turret machine, properly located, and operated by a good mechanic, would condemn and send to the second-hand store three engine lathes then at work, and still increase the capacity of the plant. But we had it clearly and plainly understood between us that without the skillful man on the machine, and the machine in line to receive and dispose of its work without clash and confusion, it would only replace one engine lathe. You can figure up the percentage yourself, same as we did. We also comprehended that this machine, to be of value, must have large bearings, stiff spindle, large cones for wide belts, with a well-made carriage and good substantial monitor stock—not a machine to do tinkering with, but one that would put out piles of work.

The question of tools for it would be, like the milling machine cutters, a small item compared to the present outlay.

Suppose I had charge of a shop (which I don't), and after making a bid on twenty dynamos, at $200 each, I receive the contract to build them. In estimating the cost I calculate that it will not exceed $160, and on that basis the bid of $200 was given. Now, suppose I find that converting two of my engine lathes into monitors will bring the cost of those dynamos down to $140. Am I not cheating those who trust their money to my use, insomuch that I do not take advantage of this very effort to earn all money possible and improve the plant equipment? Can I call myself a success as a manager or director?



BRANCH PIPE PATTERN.

Suppose I own a shop (which I don't) under the same conditions, and am supposed to have a fair knowledge of mechanical lore, and do not take advantage of those turret foot-stocks for my lathes, am I reckless, careless, foolish or a coward? Which?

The time will come when the plain foot-stock will be as hard to find in the general machine shops as the turret machine is now, while the turret will be the proper tool, and we will all chorus, "*We all knew that all the time.*" But it must always be remembered that skill and experience are needed to do good work, whether on turret machines or any other.

THE OLD MAN.

Locomotive Branch Pipe Pattern.

Editor American Machinist:

With this I send a drawing of branch pipe pattern (imperfectly drawn, but clear enough to illustrate what I want to show). The pattern maker, in his first attempt, is often puzzled to decide which of more than one way would be the best to make partings to suit the molder, and at the same time not spend unnecessary time in making patterns. I refer to such as work in repair shops, when perhaps a broken casting will be all you may have to work from. It may be said that we could see where the partings were made in the original, but that is not always wise, because "mortals err." Fig. 1 shows the end view, Fig. 2 elevation or inverted plan of same, assuming it to be in position on the locomotive. It is to the core box for branches I wish to call attention; the line *a b* cuts same through center and at right angles to axis of the body core; the dotted lines at upper part, Fig. 2, show the body core to extend beyond the line of branches, in this case 2¾". Now it will be seen that if we make core box similar to Fig. 3, and make the center 2¾" deep to correspond with Fig. 2, the one box will make the both halves, and all we have is to make a plain cylindrical core for body; the length can be easily found. Sometimes castings are made with the branches standing at an oblique angle—the three lines under Fig. 2 explain—and supposing the end view to be the same as Fig. 1, then if the core box is made to pass through axis of body in the plane of axes of branches, all we have to do is to make center deep enough to receive a wedge-shaped disk, Fig. 4 and by reversing it we can make both halves in the one box and have a square seat to engage the body core. I have not shown any core prints for the holes in flanges on branches. The pattern also parts at line *c d*; therefore must be molded in a three part flask and will mold the four bolt holes by leaving their own core.

WM. NEWTON.

Another "Talk to the Boys."

Editor American Machinist:

While reading the last issue of your valuable paper, I came across "Short Talks to the Boys," by a Practical Machinist. While many of the statements I feel to be true, I cannot agree with him in everything. Particularly do I disagree with his definition of "steadiness," as I understand him. We all know that workmen are clannish, and the same may be said of their employers.

Both the employe and the employer are apt to agree with their particular clan.

Now I belong to the employe's clan, and although I try at all times to look upon both sides of the questions, and fairly settle them in my own mind, I know, should all things be equal, I should favor the man that works ten hours a day beside me. Now I take it that the "Practical Machinist" belongs to the employer's clan.

As he follows the young man we are interested in, he is no earthly use to himself or anybody else, and I will frankly admit that if he starts out with the intention of sleeping one night in a place, he will never amount to anything, but if he starts out with a decent head—which, I believe, is a necessity for a good machinist—I see no good reason why he should not succeed.

Now I want to start with our young friend in an entirely different light than "Practical Machinist" has seen fit to place him.

We will suppose he is capable, interested in his work, and, above all, willing. He starts in to learn the trade in a first-class shop, and works a year or two, and begins to understand the principles of machinery. He is liked by his foreman and shopmates, and is ambitious to finish with a clean record, and a good trade well learned. He has no idea of leaving; but now the employer plays his part. He agrees to teach the apprentice the machinist trade, so that if he is capable, as we have agreed that he is, he will be able to command good pay, and do a diversity of work at the time he finishes his trade.

In return for this the apprentice gives his time to the employer (you cannot call it anything else) for the privilege of learning the

trade. At the end of two years the boy sees that he is not advancing as he ought to. He goes to the superintendent and asks him about it. The superintendent replies, "You are doing as well as any of the apprentices." This is all he can get out of him. The fact is, the apprentice has arrived at the time that the company he is working for is making an immense profit from his work. In fact, the boy is doing a journeyman's work for apprentices' pay, and there he will stay until his time is out or somebody dies, and they have to put him in the dead man's place. The latter seldom happens, and ninety-nine chances out of a hundred a journeyman would be hired to fill the vacancy.

Well, our boy gets into his third year, and he is clear-headed, and sees through the little scheme.

It is now a question of better work with him, or get out. He can make no arrangement with his foreman, and one day bids farewell to his shopmates, who look upon him with awe for leaving the only shop on earth (to them), for they have never worked in any other. Well, our boy starts out, and he is not the boy to get stuck on the first job that is given him. There is a little thing that helps him, and that is, no practical foreman throws the best work in the shop to a new man; if there is such a firm I have failed to find it. Well, he works here six months or so, learning more in that time as a journeyman than he would in a year or a year and a half as an apprentice. We will admit that at last he does get stuck—and, by the way, did you ever see a machinist that wouldn't get stuck once in a while? He calls up some of the other journeymen, and they see no way to do the job; if they had they would have told him. Well, he gets discharged. Now could he have done the same job under the same conditions if he had served his time out? He certainly could not, for he would be no further advanced in the business than he was when he actually did leave.

He hits another job in a day or two, and the first thing he sees is a man doing the same job he failed on When that job was done that boy knew how to do it, and you can't stick him on it again or any similar job. Well, he works here another six months, and hits a job with a quarter a day more. He takes it, and works here three or four months, until men are wanted in the shop he has just left. They like him, and how is it they can afford to pay him fifty cents a day more than they were willing to two or three months before? From the time he started in this business, he has made it a point to be friendly with the best journeymen in the shops. As time passes they are scattered to many different points. They like our boy, and respect his work. The superintendent often goes to such men and inquires for a good hand. The journeyman stops, and suddenly a smile strikes his face. "Yes, there is a fellow I know, and I can recommend him, but you will have to pay him to get him." When our boy gets the superintendent's letter, he goes and has a talk with him, and, after working his notice, he tries his new job. From this time on he is open to any engagement where there is more money or a chance to enlarge his knowledge of mechanics.

At last he visits the shop he commenced his trade in. There are the same old faces; very few new ones. The apprentices have been out of their time for a few months. They are getting $1.50 per day, and a promise of a ten-cent raise per year until the magnificent sum of $2 is reached. That is the height of their ambition.

Now I ask you frankly, reader, which is the more valuable machinist, and which receives the most pay? Now do not misunderstand us. Our boy would never have left his first love if he had a chance to advance, but he had no such chance. Our boy has the making of a man in him, while that of the "Practical Machinist" will always remain a boy.

There is as great a difference in boys as there is in men. I love to see a smart boy get along—it does my heart good; but I advise no boy to leave one shop to enter another, unless he sees some benefit for the change. Apprentices, do not rate these whiffle-minded youngsters that stay but a day in a place with yourself. They will never become machinists, while you, with judicious changes, will become the man these men will some day apply to for work.

W.

American Boasting.

Editor American Machinist:

I have been very much interested in the discussion anent American boasting, and hope the theme is not yet worn threadbare. Boasting I hold is in bad taste anywhere or under any condition, but am inclined to criticise the statements of so eminent an authority as Prof. Sweet. He states or intimates in his recent article that there are mechanical operations performed abroad which we cannot duplicate at home. American mechanics can certainly make as useful and handsome pillow blocks as are made anywhere, and utility and appearance are the two principal considerations. As regards the small iron shells, it doesn't matter much whether we can make them or not, viewed from the utility standpoint; but when it comes to difficult mechanical operations and the finest appliances, and the direct benefits that accrue to mankind, I would refer him to the American watch and watch tool factories, of which I happen to know a little. Where will you find a man like Moseley or Webster in Europe or anywhere else, and a host of other American mechanics who have developed the watch industry (the finest work, as work goes, as there is) to a point where they can laugh at all the others in the world if they were so disposed? The Swiss are forever dumping imitative American watch tools into this country, but in point of workmanship do not even approach the products of at least two of the American factories. Now why is it? Lack of will or ability? As regards the lenses, if skill produces the glass, why don't they produce the casting the first time instead of sometimes making two or three hundred casts before even submitting a sample to the Clarks. That looks to me like trusting to chance as much as anything, and if the grinding is less difficult than the casting, why do all the astronomers in the world come to Alvin Clark's Sons? H. H. HARDINGE.

A Belt Tightener.

Editor American Machinist:

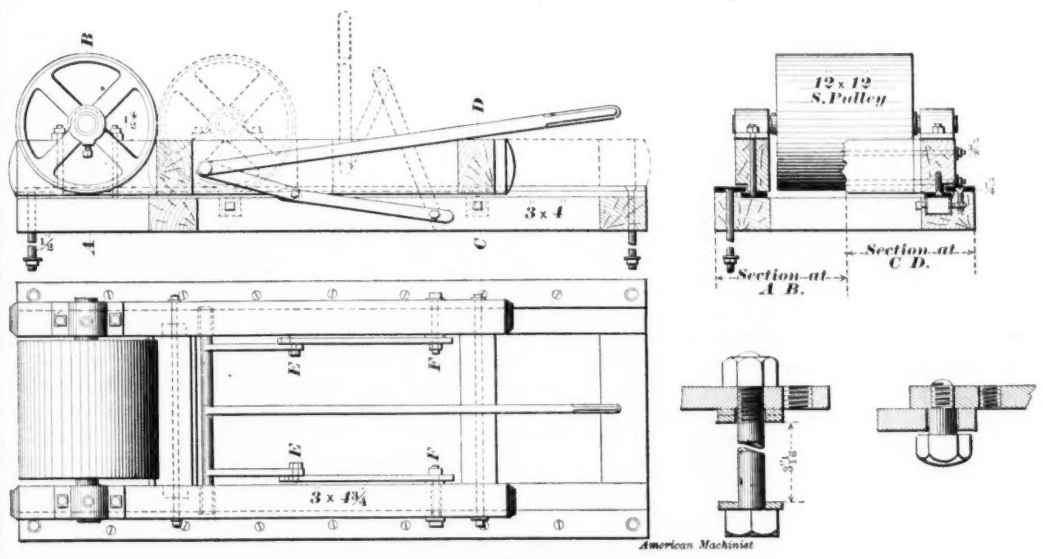
While supervising the detail construction of the new Palmetto Brewery at Charleston, S. C., it became necessary to construct a belt tightener, and as there was no time to think of rack, pinion, hand-wheel and ratchet, I improvised the idea of toggle-joint lock leverage as shown on blue print, in full and dotted lines.

As will be seen by referring to the drawing, we get the best possible purchase just where it belongs, but its superiority over the usual construction is the quickness with which it can be thrown out—one yank upwards of the hand lever being all sufficient—and the gradual ease with which it can be thrown in when the section it operates is to be started. It is essential to put rollers in as shown, though I left them out at the one put in as above stated, more on account of time than anything else, and although it worked all right, nevertheless, the rollers would have eased it and made it what I would term "perfect." I allowed a sixteenth clearance on each slide sidewise, and the same between the flat irons; this gave just the right amount of play to work smoothly, and although it might appear loose, this is not the case, inasmuch as there will be some winding with the most careful mechanic's work. The holding-down bolts shown at each end can be placed further in than shown, or more can be added at center if found necessary on larger sizes or where good material is hard to find and "shimming" has to be resorted to.

When I had finished the drawing it certainly looked tricky, or as I termed it, "grasshoppery," to be more expressive, but no one remarked a word, and not a few were curious as to how it was going to work—"how was I to keep it there once the belt was tightened," etc., and I must say I was not a little amused at the satisfaction every one expressed—on their faces—as they raised and lowered the lever. (A *good* thing always pleases.)

As will be noticed by again referring to the drawing, the only forging is the lever and toggle shaft, the pieces being "jumped" on, and the countersunk-head bolts; the balance is simply drilling, tapping and turning. I would mention right here that the tapping and drilling should be reasonably square, especially where the toggle link bolts pass through the string-pieces of the lower frame, If any of your readers should have occasion to construct a tightener of this sort, and at the same time feel a little skeptical regarding getting these bolts true and square, he could run a rod clear through and separate the links with pipe nipples, but this does not make solid, smooth working.

WM. M. LINNETT,
Engineer and Architect.



BELT TIGHTENER.

Aerial Navigation.

Editor American Machinist:

Having read, in your issue of August 25, Mr. Harrison's somewhat facetious criticism of Mr. Maxim's experiments, I beg leave to assure your readers that Mr. Harrison's opinion regarding aeroplanes is no longer debatable, but absolutely erroneous. Every student of aviation knows that a horizontal plane falls more slowly when it possesses some horizontal motion than it does when falling vertically. If there were any doubt on this point it could be easily removed by a very simple experiment, and I would refer anyone interested in the subject to Langley's description of experiments with the plane-dropper given in his Researches in Aerodynamics, published by the Smithsonian Institute last year. There ought to be no difficulty in tracing the analogy between a soaring plane and a soaring bird.

It is well known also that the resistance encountered by a plane moving at a fixed angle and velocity through the air depends not alone upon the extent of surface, but upon the form as well. An aeroplane, for example, of elongated form, will, when moving sidewise through the air, support far more than when moving endwise. Hence, even if Hutton's tables and formulæ were correct—which they are not—it would be absurd to apply them, as Mr. Harrison has done, to test the accuracy of Mr. Maxim's results.

It will be useless to notice the other more egregious mistakes of the article, such, for example, as his extravagant claim for the animal muscle as a transformer of heat into mechanical energy, or his derivation of the term tachometer. Suffice it to say that there seems to be something of inveterate malignity in Mr. Harrison's attitude towards all experimenters in the range of aerial locomotion. It would be well, however, for one who attempts to dogmatize in this subject to read and understand the latest researches, lest in the sequel he appear as an inglorious theorizer, while the one attacked proves to be both a scientist and a "practical" man.

ALBERT F. ZAHM.

Flies and Drawing Ink.

Editor American Machinist:

From a question and subsequent answer in your paper I see that you don't know a remedy for flies eating the drawing ink from a tracing. To keep the flies off while working at a drawing, pour in a few drops of vinegar, and this will prove sufficient, and still the ink will be as good as ever.

When not working, a sheet of *clean* paper should *always* cover the drawing.

C. L., M. E.

[Our correspondent is mistaken in writing that we do not know of a remedy for flies eating the ink off a drawing or tracing. He will find the remedy given in answer to the question to which he refers. Flies will not touch ink that is mixed fresh every morning and noon. During an experience of 25 years we have had no trouble from flies whenever we have used fresh ink of the best quality, as should be used.]

Editor American Machinist:

We are very glad that we can give an efficient remedy to the fly plague in the drafting room, referred to in Question 373.

Flies enjoy the india ink because it is toothsome. To make them quit you should spoil their appetites by putting into the ink something that will upset their inner fly. This may seem to be only the other horn of the dilemma, the taste of the fly being so generous and so broad; but we have found that, by rubbing the ink in water tinctured with muriatic acid, the ink loses its attraction for them, not only when it is wet, but *when dry as well*. Probably hartshorn, acetic acid, wood alcohol, and many other substances will do, but we can answer for muriatic acid. To the long suffering draftsmen who have seen their solid lines become hatched, and their drawing stippled by the too-industrious fly, we give this knowledge gladly, free of charge. HENRY BINSSE.

Editor American Machinist:

I would say in answer to the inquiry of F. J., Pawtucket, R. I. (373) in your column of Questions and Answers in the issue of the AMERICAN MACHINIST for September 8th, in regard to anything to put in drawing ink to stop flies from eating it off drawings, that we have found here that it did not matter how fresh the ink was mixed, that they would eat it off just the same, but that if a little acetic acid or vinegar was mixed with the ink they would not touch it at all. We have also found that they will not touch the prepared Higgins' American india ink of either the general or waterproof kind. I think if F. J. will try the above he will find it to work satisfactorily.

S. CUYLER GREENE.
Bath Iron Works.

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Possible Competitors.

Some time ago, while walking with one of the proprietors through one of the largest and best known machine shops of the country, we noticed some men who were packing a machine for shipment.

The shop had recently been equipped with overhead traveling cranes for handling the heavy work built there, and the men were enjoying the use of them, and their release from heavy lifting and tugging. At the moment our attention was attracted to these men, a sling chain had been thrown around a small part of a machine weighing not over 50 pounds, and the 50-ton crane was employed to raise this piece from the floor and deposit it in the packing box, while the three men, any two of which could easily have lifted it to place in one-fourth the time, stood by and rested.

The proprietor remarked that such things had formerly worried him somewhat, but he had come to perceive the great truth that if all the men they hired were so thoughtful and so smart as to know the very best way to do everything, and infallibly choose that way, if, in short, they possessed all the qualities that make men successful as managers, they would certainly want to become managers and proprietors, and would probably become his competitors. In other words, he was able to hire these men only because they were in the main lacking in some one or more qualities essential to success as proprietors of shops of their own and he had, therefore, learned to consider such matters more philosophically, and be satisfied when he thought his men were as good as those in any other shop.

There is, in this incident, something to think about by both employers and workmen. When men who work in shops have as an object something beyond their daily wages, the chances are that they will get it. This may mean to the employer not only an efficient workman, but a possible competitor, while to the workman it means that, if his ambition extends only to 6 o'clock and payday, he will in all probability have to be satisfied with these as his sole rewards.

We are not among those who believe that all men can be equally successful in any given line, for men differ from each other physically and mentally. But it is certain that every man owes it to himself to make the most of his natural abilities.

Manufactures and Land Booms.

We regret to note that there seems to be an increasing tendency to mix manufacturing enterprises up with land-booming schemes, some of which are, to say the least, rather shady. Some of the manufacturing establishments which have been induced to change their location by some such schemes we know to be those who, for good reasons, have failed to succeed in their first location, and who probably would not be invited to move to any particular location by men who were at all careful as to whom they held out inducements.

The fact is, that many of these schemes are nothing more than schemes to sell, in small lots, land at, say, $1,000 an acre which is not worth over $100 an acre. It is true enough that first-class manufacturing establishments sometimes move from one place to another, and there has been considerable of this moving during the last five or six years, but it will usually pay those who think of investing in lots which are be ing boomed on a manufacturing basis to investigate the record of the alleged great manufacturing enterprises in the towns from which they are to move.

A notable instance of land booming on an alleged manufacturing basis was that of the contemplated town of Essen, which was to be built near Cincinnati a few years ago, and the basis of whose prosperity was to be the location there of immense locomotive shops. Large pictures of these visionary shops were published, and the lot-buying public was asked to believe that it could hardly pay too high a price for lots in Essen. In this case it happened that the matter was a little overdone, and it was too easy to ascertain whether or not there were any master mechanics who indorsed, or railroad companies who were ready to buy the new locomotives that were to be built there, the consequence being that the lots, so far as we have heard, remain unsold, and the works are still on paper; some of the paper in the back volumes of our esteemed contemporaries.

It may not be so easy to find out important facts regarding alleged great manufacturing enterprises that are already established, but are to be moved to the new "Boomville," but it will pay in most cases to go slow and investigate.

The Lack of Work.

A peculiarly sad case is that of a workingman living in Newark, N. J., with his wife and children, and who bought, while he had regular employment, some goods on installments. He lost his situation, and, not being able to obtain another, was arrested upon complaint of the merchant to whom he was indebted, and while attempting in court to explain the matter, trembled violently, showed great agitation, and finally dropped dead upon the floor of the court room.

It should be remembered that while those who sell goods on the installment plan will usually be very pleasant and apparently very accommodating to a prospective customer, they are very apt to be extremely harsh and inconsiderate in their subsequent treatment of him, and unless a man can be almost certainly sure of being able to meet all payments as they become due, it is far better to do without the goods until the money is in hand to pay for them.

It is very sad, too, to think that there are men who are willing and able to exercise their natural right to labor for the support of themselves and families, who are debarred from doing it by causes over which they seem to have no control. Those who think and teach that any man who really wants to work can always find something to do, would be enlightened a little on this point, could they know the real difficulties that surround the average man who is looking for work. And it is the average man, or those who are below the average, that in the main experience the difficulty. The best men, the extraordinary men, have little or no trouble usually; but it is no solution of the difficulty to tell a man who has nothing to do, and a family to support, that he must make himself better than the average. All men cannot be better than the average men, and some must be below the average. It is cruel and thoughtless to say that these latter must starve because they are not superior to others. When every man who wants to work can find work to do that will remunerate him in proportion to his ability and energy, the labor problem will be solved. In an entirely new country which is to be developed this is always the case, and men, while not equal in ability and industry, are equal in opportunities to go to work and earn an honest living. But as countries grow older something seems to step in between men and their opportunities to work. This can be nothing more nor less than monopolies of various forms, and when these are removed, not only the labor question, but the questions of socialism, anarchy, etc., may be safely left to settle themselves.

How some newspapers fight for a cause, which for any reason they have been led to espouse, is shown by two extracts from the *New York Times* of recent date. One of these gives an account of the killing of a woman by a Broadway car. She was attempting to cross the street, and was struck by the car, run over and killed. The fact is announced in a matter-of-fact way, and under the smallest headline. About the same time, a conductor on a trolley road in Brooklyn was knocked down by a trolley car and run over. He was not killed, but had to have one of his legs amputated, and the article is published under prominent headlines announcing "Another Trolley Victim." Of course both these accidents were entirely independent of the means employed to propel the cars, but the difference in the treatment of the two cases is due to the fact that the *Times* is just now fighting the trolley wire, and the loss of a leg caused by a trolley car is, therefore, of more importance than the loss of a life caused by a car drawn by horses.

It is reported that several other orders which are founded upon much the same principle as the Iron Hall are likely soon, like it, to go to pieces, the reason being that the confidence of members in such orders has been severely shaken, so that investigations are demanded, and these investigations are more than likely to show in many instances a very bad state of affairs. It will, of course, seem hard that members who have paid their hard-earned money into these orders should lose it, but it is far better for all concerned that rigid investigations should be had in every case where there can be room for doubt. Such an investigation, made by the properly constituted authorities, will always be beneficial to orders which are sound, not only by making known the fact of their soundness, but by removing from the field orders which are unsound, and which only tend to give a bad name to all such schemes, whether good or bad. It is to be hoped that the Iron Hall failure will lead to the sifting out of all assessment and benefit orders whose methods will not bear rigid investigation.

We have received the Thirteenth Annual Report of the Wells Memorial Institute for Workingmen, which is located at 987 Washington street, Boston. We have before outlined the work which this institute is carrying on, and it is only necessary to say that the report now before us shows that the good work done in the past by it has been continued. Every workingman in Boston should at least investigate what is being done by this institute, and can then decide whether or not it can be of benefit to him. The lectures given under its auspices upon scientific and technical subjects are especially worthy of attention, and the advantages which it offers as a club are by no means to be despised.

A new edition of the Brown & Sharpe Mfg. Co.'s small blue catalogue has been issued, and, as usual, is found to contain illustrations and descriptions of a number of new machines and small tools of various kinds, the present edition having 248 pages. As most of our readers know, this catalogue contains a great deal of information that is of value to mechanics, and this, together with the fact that it is sent free to any address upon application, has made it a standard book of reference in machine shops and tool rooms. The catalogue is an educator, and should be sent for by all who are interested in machine tools and the best methods of doing machine work.

Any one sending his address to the company, at Providence, R. I., will receive a copy.

We have received from the Secretary of the American Railway Master Mechanics Association, Mr. Angus Sinclair, the Report of the 25th Annual Convention at Saratoga. The unusually interesting character of the proceedings at this meeting, and the large number who participated in the discussions, make the volume larger than usual, and the promptness with which it has been issued is very creditable. The volume is a valuable addition to the record of current practice in matters connected with railway motive power.

The Albany Foundry Apprentices Association began its regular meetings for the winter, Monday evening, the 12th inst., at 940 Broadway. All foundry apprentices in Albany are invited to attend these meetings. It is thought probable that two meetings per week will be held during the winter.

A very interesting exhibit in the transportation department of the World's Fair will be made by the steamship and railway companies of England. The collection of models of battle-ships, yachts, cruisers, steamers and merchant vessels will be more complete than was ever before exhibited. The London and

Northwestern railway will send over a complete train of cars headed by a great compound locomotive named "Great Britain." This will afford an opportunity to compare the English compartment cars and sleepers with American coaches. The Great Western railway will exhibit the antiquated locomotive "Lord of the Isles," one of the first used on that road. Several of the railways will show their signaling systems.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(396) J. F. A., Montserrat, West Indies, writes: Please inform me of a good practical work treating on architecture. *A.*—There are so many good works treating on this subject that it would be an injustice to many if we simply mention one. Write to any dealer in scientific works for a catalogue. The addresses of some of these dealers are given in our advertising columns. They can also tell you which is the most popular work

(397) S. F. P., Naugatuck, Conn., sends a sketch of two spur gears working together, one of these being nearly three and a half times the size of the other. He asks: Will there be more strain on the gearing when transmitting power from the larger gear to the smaller than when transmitting from the smaller to the larger, the power and rate of speed to be the same in each case? *A.*—No; the strain will be the same under either condition

(398) F. M., Chicago, asks: Will you give me the most correct angle for the teeth of spiral mills, say $2\frac{1}{2}$" diameter, $2\frac{1}{2}$" face, and also state whether or not it is practicable to use different angles for brass and cast-iron? *A.*—The exact angle of the spiral is not important. About 10° to 15° answers very well. We do not think the different metals require different angles of spiral, and it would not generally be practicable to make them of different angles.

(399) W. W. B., North Platte, Neb., writes: Please answer through your Notes and Queries if you can give me any information about a car starter or mover which exerts its power against the body of the car instead of against the wheel. I am told that such a one is made. *A.*—Such a device is made, but we cannot recall sufficiently the construction of all its details so as to describe it. Probably some of our readers or the maker will send us drawings of it.

(400) J. C., Amsterdam, N. Y., asks: Which is the best book on electricity for one who has mastered that which is contained in Wells' Natural Philosophy? *A.*—It is impossible to say which is the best book. Works by S. P. Thompson, T. O. Sloane, F. L. Pope, are good books. 2. Which are the leading text-books used in colleges where electrical engineering is taught? *A.*—It is difficult to answer this question, as same text-books are not used in all the colleges.

(401) M. T. P., Philadelphia, writes: In answering my question (No. 372, issue September 1), it appears to me that you have not considered the relative speeds of the screws and crank. Please explain if I am wrong. *A.*—You are not wrong but right. After computing the relative speeds as shown by our solution, for the purpose of taking it into account in the equation, it was overlooked entirely in forming the equation. The result should be divided by 14.5, the ratio of the speeds of the first shaft and the screws.

(402) J. Z., New York, writes: I have built an engine with cylinder $1\frac{1}{2}$ inches diameter and $2\frac{1}{2}$ inches stroke. Please answer through your columns if it has power enough to drive a 12 foot boat with four people in it. If not, please state if I can drive the boat with a smaller number of people in it. The engine takes up a large space. *A.*—The engine is large enough for a 12-foot boat with four persons in it. Its power will depend on the steam pressure, and its speed will depend much on the steaming capacity of the boiler and the form of the lines of the boat. 2. What should be the size of the propeller? *A.*—Diameter, 10 inches; pitch, 18 inches.

(403) J. Q., Dunellen, N. J., writes: A friend of mine has built for himself a flat-bottom sailboat; it is 21 feet long, 8 feet beam, and 24 inches deep amidship. Centerboard is 5 feet long and 2 feet deep. The bottom part of the boat at the bow stands 1 foot out of the water when empty. Will you please tell me how it can be altered so as to appear right on the water? *A.*—The mast or center-board are placed too close to the stern of the boat, and either one or the other, or both, may have to be moved forward. If we had a drawing of the boat we would be in a better position to advise you. Sometimes as a last resort lead is put in the bow, but this is not advisable, as it will be a dead load to carry at all times, and will consume considerable of the propelling force.

(404) C. A. H., ——, writes: We have had considerable trouble in balancing some cones that we are making. They are about 27" long, 12" diameter at one end, and 7" at the other. They are secured to a $1\frac{7}{16}$" shaft, weigh about 50 pounds each, and are to run at 1,000 revolutions per minute. Can you give suggestions in regard to balancing these? *A.*—They may be balanced in the same way as revolving cylinders are sometimes balanced. Mount them in bearings which are secured to their seats by bolts passing through elongated holes or slots, so that the bearings are free to move laterally a small distance. Put a light belt over the cone and drive it at such a speed as will cause it to move the boxes if out of balance; then mark the cone at each end while running the same, as in truing up work on the lathe face-plate. These marks will indicate the heavy side. The final test should be at the regular running speed.

(405) J. G., Minneapolis, asks: What pressure will three screws give that are $1\frac{1}{2}$" diameter, 6 threads per inch, one man on each screw pulling 150 pounds, with a lever 3 feet long. Please give formula to get friction; nuts are 2" thick, wrought-iron, screws of steel. *A.*—Barring difference of friction, the pressure will be the same as though the three men applied their power to any one of the screws; and it is more convenient to combine their power in making the calculation. Power applied at the end of a lever 3 feet long moves in the circumference of a circle 6 feet diameter, and consequently moves a distance of 18.85 feet in one revolution. The screw being six threads per inch, the nut or weight is moved $\frac{1}{6}$" per revolution, which is equal to $\frac{1}{72}$ foot, and the equation then becomes:

$$\tfrac{1}{72} : 450 = 18.85 : \text{pressure}.$$

This gives us 610,740 pounds for the pressure. There is no formula for the friction of such an arrangement, but experience shows that the friction will be about 70 per cent., and the actual pressure would therefore be reduced to 183,222 pounds.

(406) J. A. F., Bridgeport, Conn., writes: Please give me the latest rules used by the United States local inspectors for computing the weight of a safety valve, the length of lever, distance to fulcrum, and size of valve being given. *A.*—Correct rules do not change, and therefore there can be no "latest rules." The weight on a safety valve lever is found as follows: Multiply the weight of the valve and stem by the distance in inches from the center of valve to the center of fulcrum. Multiply the weight of the lever by the distance in inches from its center of gravity to the center of fulcrum. Add these two products and designate sum by "*A*." Multiply the area of the valve in square inches by the steam pressure in pounds per square inch, and by the distance from center of fulcrum to center of valve. From this product subtract the sum *A*, and divide the remainder by the distance in inches from the center of fulcrum to the center of the weight; the quotient will be weight in pounds. If, for instance, the distance from the center of valve to the center of fulcrum is 3 inches, the weight of the valve and spindle 10 pounds, the weight of the lever 15 pounds, the distance of its center of gravity to the center of fulcrum is 12 inches; diameter of valve, $2\frac{1}{2}$ inches; steam pressure, 120 pounds; and the distance from center of fulcrum to center of weight is 24 inches; then we have:

$$10 \times 3 = 30$$
$$15 \times 12 = 180$$
$$210 = \text{sum } A.$$

The area of a valve $2\frac{1}{2}$ inches diameter is 4.9 square inches; $4.9 \times 120 \times 3 = 1{,}724$. Subtracting the sum *A* from this product, we have $1{,}724 - 210 = 1{,}554$; and $\frac{1{,}554}{24} = 64.75$ pounds for the weight in pounds. See also answer to Question 227, in our issue of May 19, current volume.

(407) C. F., ——, writes: Will you give information as to the best method of tempering milling cutters, and as to the quality of steel they should be made of? *A.*—We have frequently given the methods of doing such work. Small milling cutters may be heated in a lead bath, or in an open fire, and quenched in the ordinary manner. For larger cutters the fire is best, and charcoal is preferred. For very large cutters a muffle should be used, and, if possible, a furnace. As to quality of steel, we believe firmly in using the best for all such purposes, and the maker when he receives the order should be informed as to the purpose for which the steel is to be used. It is an excellent plan also to mark every cutter made in such a way that the steel of which it is made can be always known. It is necessary to mark upon it nothing more than a simple number or letter, the significance of this character being recorded in a book kept for that purpose; such a system would often give valuable information regarding the cause of failure or of superior efficiency of cutters, and show conclusively what kind of steel is best to use.

(408) W., Denver, Col., writes: I have a lathe which was fitted up for cutting threads by the mechanic who owned it before me, and he arranged it with a swinging plate having two studs, upon either or both of which two gears can be placed, thus making it either single or double compound. I send sketch of two sample arrangements, and would like to know the number of threads cut by them, and the rule for figuring them. *A.*—In the first arrangement there is on the lathe spindle a gear with 10 teeth; on the first stud one gear having 32 teeth; on the second stud are two gears, the driven one having 28 teeth and the driver 16. On the lead screw is a gear of 36 teeth, and the screw is cut 10 threads per inch. We may disregard the gear on the first stud, because it does nothing but transmit and change the direction of the motion without affecting its rate. The drivers in this system are the gears 10 and 16; the driven gears are 28 and 36. We can solve this by cancellation, as follows:

$$\frac{10 \times 16}{28 \times 36} = \frac{10}{63}.$$

This shows that the ratio of the speeds of the spindle and of the screw will be as 10 to 63, or that when the spindle makes 10 revolutions the screw will make 63; or that when the spindle makes one revolution the screw will make 6.3 revolutions. It is evident now that if the lead screw were cut one to the inch, the lathe would cut with these gears 6.3 threads per inch, but being cut 10 per inch the lathe cuts $6.3 \times 10 = 63$ threads per inch. We now see that we could have obtained the same result by arranging for cancellation, thus:

$$\frac{10 \times 16}{28 \times 36 \times 10} = 63.$$

Hence the rule: Multiply the drivers together, and divide this product by the product of the driven gears and the number of threads per inch of the lead screw. This is what we have done in the last cancellation. The same principles apply in the second case, where compounds are used on both intermediate studs. The drivers here are 10, 18, 16, and the driven gears 32, 36, 38. The solution, then, is as follows:

$$\frac{10 \times 18 \times 16}{32 \times 36 \times 38 \times 10} = 152.$$

Cancellation is a very simple matter, and those who do not understand it may easily do so by consulting any arithmetic.

(409) E. L. S., Massillon, O., writes: Please answer the following questions: It is claimed by "A." that if one pump of a water-works system is throwing a single stream from a fire hose to a certain height, that, by adding the pressure of another pump of the same size, the stream will not be thrown any higher. "B." claims that it will. Who is right? *A.*—It depends upon the relative capacity of the first pump and the hose or nozzle. If the first pump is large enough to fully maintain the maximum pressure in the system, the addition of a second pump will not affect the height of the jet. 2. Have you any back numbers containing instructions for drawing the concave worm-wheel? I have several books on drawing by different authors, but they just mention it and give a section. *A.*—See our issue of July 2, 1891. Copies of this issue can be furnished by us. 3. What should be the surface velocity of a grindstone? *A.*—The speed will depend on the quality of the stone. For Ohio stone a surface speed of 2,000 to 2,500 feet per minute is probably the limit of safety, and for Lake Huron tones from 2,800 to 3,500 feet per minute. See our issue of March 6, 1890. 4. How can I find the diameters of step pulleys? *A.*—See our issue of December 1, 1888. 5. How can I compute the strength of a beam supported at both ends when I know the tensile strength of the metal? *A.*—The load which a rectangular beam can support with safety at its center is found by the following formula:

$$W = 4 \times \frac{s \times d^2 \times b}{6 \times l},$$

and when the load is uniformly distributed the formula becomes

$$W = 8 \times \frac{s \times d^2 \times b}{6 \times l}.$$

In which W is the load in pounds, d the depth in inches; b the breadth in inches, and l the length in inches, and s about one-fourth of the ultimate tensile strength. 6. I have been studying drafting for the last two years, but there seems to be no end of learning. How soon could a person make application for a position? *A.*—That depends on the ability of the person and the kind of position he applies for. There are boys making applications for positions in the drawing room with scarcely any knowledge of drawing, and get along, and there are others making application for higher positions, who prove themselves to be worthless, and probably will always remain so. 7. Would I have to know much of engineering? *A.*—That depends on the kind of position you seek to fill; but generally the more you know of it the better for you. 8. Should I study geometry and algebra before making application? *A.*—Not necessarily, but since these are very important branches of mathematics in a drawing room, and useful in many other professions, you should lose no time in commencing these studies.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Best quick-return motion known. See page 20.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

A. D. Pentz, Consulting. Tools. Elizabeth, N. J.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

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S. A. Smith, 23 S. Canal St., Chicago, Ill., is agent for Holbrook's new loaded rawhide mallets.

Pulley lathes, most efficient offered. Ohio Machine Tool Works, Cincinnati, O.

J. S. Thurman, M. E., Indianapolis, Ind., Expert Patent Solicitor. Inventions Perfected.

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For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., cor. Canal and Washington Sts., Chicago, Ill.

Patterson, Gottfried & Hunter, Limited, 146-150 Centre st., New York, are putting on the market a new alarm speed indicator. Send for circulars.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

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De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Cogging Wheels—IV.

By JOSEPH HORNER.

Fig. 23 (page 10) is an illustration in section of the tooth block employed for molding a bevel mortise wheel. The method by which the section is obtained and worked is shown in Fig. 24. In this figure, *A* is the center of the wheel, *B* corresponds with the lower face of the flat arms, and *C* with the beveled face of the wheel through which the mortises are cored. *D* and *E* correspond with the upper and lower edges of the rim. The depth *F* is of no importance, neither is the width *G* nor the length *H*; *F*, *G*, *H* bear no relation to the rim section of the casting, but are simply made to suit the dimensions of the carrier of the wheel molding machine, and the top and the interior of the wheel are formed with cores.

First of all, a cubical block of wood is planed and squared to the thickness *J* of Fig. 24, to the width *G*, and the length *H*. The width *G* is immaterial, because the back of the block bears no relation to the actual wheel, being simply a vertical face to

bolt the vertical face of the carrier to. There are certain cardinal dimensions and lines upon the bevel wheel, which, being struck out upon the cubical block, afford the necessary guides for working out its sectional and plan outlines. These dimensions and lines are shown dotted in Fig. 24, and are marked thus: First, a center line *a a* is squared around the cubical block, and the curved line *b* struck with radius $A - b$ from the center *A*, situated upon the center line $a - a$ prolonged. Then from the same center *A* the line *C* is struck. The block is then turned over, and the line *b* struck upon the opposite side, and from the same center *A* the lines *d* and *e* also. The curved face *b* is then sawn and planed across, and the gauged line *f* run around it parallel from one of the faces. It is now easy to work the two sloping faces *C* and *D* from *b* to *d*, and from *b* to

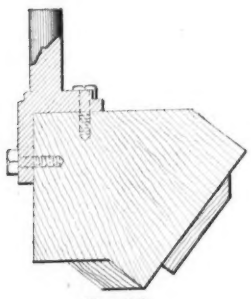


Fig. 23.

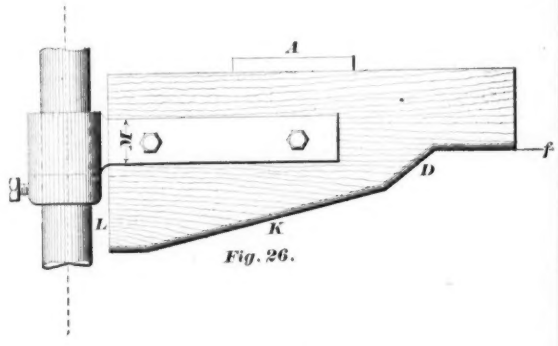


Fig. 26.

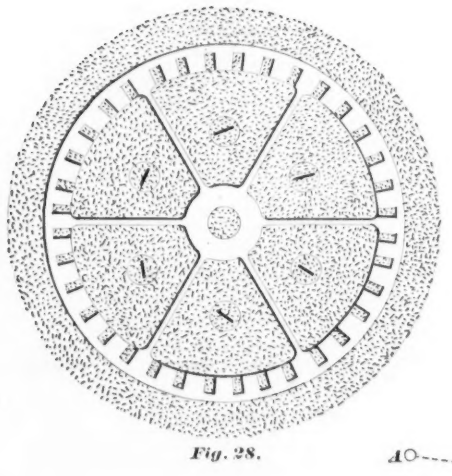


Fig. 28.

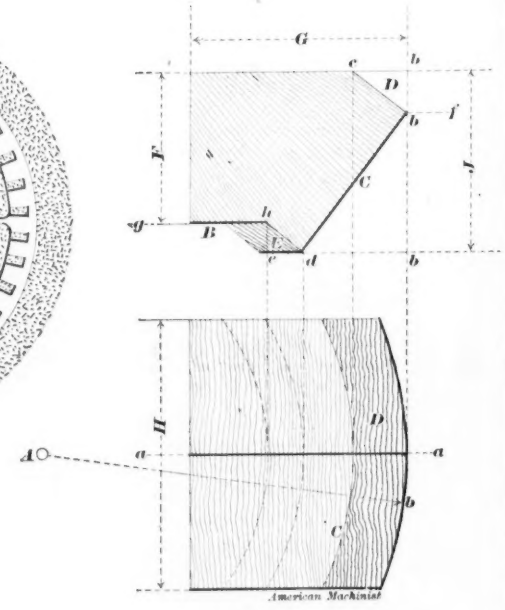
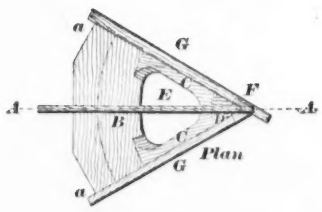


Fig. 24.



Section A-A
Fig. 27.

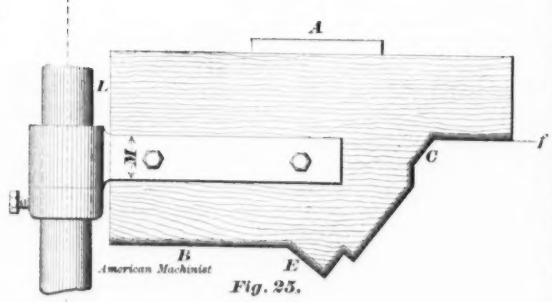


Fig. 25.

the prints, and is carried out horizontally at *f* to form the level bed for the joint face of the cope. The beveled edge *E* forms the edge of the rim on the smaller diameter of the wheel. A comparison of these profiles and reference letters with those in Fig. 24 will render the relationship of the block and lower striking board clear. The board which strikes the cope is shown in Fig. 26. *K* strikes the top edges of the arms, *D* the edge of the rim on the larger diameter of the wheel, and the joint face *f*. It is clear that, when the cope struck with this board is turned over upon the lower part of the mold, the section of the wheel, minus the cores, will be produced. *A*, in Figs. 25 and 26, represents a spirit level. We plane the top edges of these boards dead square with the ends *L*, and therefore parallel with *f*; and the level placed on the top edge affords a test of the horizontal accuracy of the boards. As the width *M* of the strap bears a small proportion to the length of the board, it would be quite probable that in the absence of the level test the boards would not be fixed horizontally. Every molder knows what bother that means when putting work together. Using the spirit level, it is easy to insure the horizontal accuracy of joints, and consequent truth of dimensions at center and circumference.

c. Another gauged line *g* is then run round from the lower face, and the block rebated down to it from the curved line *e* perpendicularly to *h*, and immediately following the beveled edge $d - h$ is worked round with a template set against the face *g*. As these faces are worked, the center line $a - a$ will also be carried over them, and from that line the position of the prints for the mortise cores will be pricked off to right and left with compasses, and the prints fastened on, just as on the face of a pattern. This completes the tooth block.

There are two striking boards required for striking a bed and a top respectively for the block and for the cores; and a core box is necessary for the arm boss, and the interior of the rim. These are shown in succeeding figures.

Figs. 25 and 26 illustrate the boards. Fig. 25 is that used for striking the bed. It makes the bottom face *B* of the arms, and the face *C* of the wheel, with the profile of

Very often the practice is to combine top and bottom boards in one, cutting the two edges in one piece. There are also several modifications adopted in the details of striking boards, the description of which details would be rather foreign to my present subject, occupying space which must be devoted to the description of the actual cogging of wheels.

The core box is shown in Fig. 27. Its cores form the inner face of the rim, the flat arms, the vertical arms, and the boss. The sweep *B* forms the internal face of the rim. *C C* are the arms, jointed along the line $A - A$. *D* is the boss. *G G* are the box sides, detachable from the other parts; the inner faces *a a* of *G G* form the faces of the vertical arms. *E* is a strickle employed for sweeping off the tops of the cores to the same slope as the edge *K* of the board in Fig. 26. It is kept in true radial position by means of the template *F* nailed to the top of the box.

The core-box for the mortises is just like that used for a pattern wheel. These cores are placed in the mold first, then the arm cores, and lastly the cope is put on. The mold cored up in readiness for the cope is shown in Fig. 28.

After the wheel is cast, the face, and also properly the edges of the rim, are turned, and the center hole bored and keywayed. It is better also to let a boy clean out the sand, and a little of the worst of the surface scale from the mortises with an old, nearly worn-out file, and also to very slightly chamfer the edges next the turned face, in order to facilitate the free driving of the cogs. After this the wheel is given into the hands of the pattern maker or millwright, to be cogged.

It seems to be reasonably certain that some persons who ought to be cool and collected in the face of such an emergency as is presented by the siege of cholera have almost completely lost their heads, and are panic-stricken. On no other hypothesis can the fact be accounted for that 500 men, women and children, among whom no sickness had occurred for about 14 days, were cruising about the waters of New York bay for two days and nights in search of a place where they could land. The fact, too, that cabin passengers, among whom there had been no sickness during the seven days' voyage, were kept for about a week aboard a ship on which there had been deaths from cholera, while those who had been directly exposed to the disease were removed to a comparatively safe place, seems preposterous. It should not be overlooked, however, that the prime cause of this state of affairs seems to be the greedy action of the Hamburg-American Packet Company, which allured many cabin passengers aboard the *Normania* by false statements that no steerage passengers were to be carried, and which continued to ship emigrants from Hamburg after it became well known that the city was thoroughly impregnated with cholera.

It is, of course, necessary to maintain a strict quarantine. It should be remembered, too, that cabin passengers are liable to lie, in order to escape quarantine. We have the best of reasons of believing that a woman, a cabin passenger on the *City of Berlin*, stated to the health officer, in reply to a question, that she had been in England for some weeks before sailing, while the fact was that she had come directly from Russia to board the ship—a fact which, if known, would have caused her detainment, as she had been previously warned.

The Reflection Liquid Gauge Co., of Boston, Mass., has been formed, to manufacture a new water glass gauge which is a German invention.

The invention consists of a metallic casing connected at the top with the steam, and at the bottom with the water. The front of this case is closed by a heavy plate of glass which is smooth upon its outer surface, but at the back is ridged vertically in the form of triangular prisms, which, when there is no water to fill them, refract and reflect the light in such a way as to make the glass appear silvery bright. But where the water rises and fills the prismatic grooves the light is not reflected, but absorbed by the black surface behind the water, so that the water line is always shown with great clearness, even in comparatively dark places.

In 1822, a patent was issued to Jeremiah Bailey, of Pennsylvania, for a mowing machine, and he constructed two machines the same year. It is believed that these were the first ever made. A number of years later a patent for improvement on this machine was secured and some fifty of the improved machines were built. Only two of the original pattern were ever made, and one of them is still in existence, owned by Samuel Worth, of Marshallton, Pa. He will exhibit it at the World's Fair, where, as a pioneer in agricultural machinery, it will attract much attention. The knife of the machine is circular and had a combined rotary and forward motion.

Shakespere has long had the credit of "anticipating all that can be said," as to most matters, but it was also reserved for him to furnish material for about the neatest lead pencil advertisement we have seen. The Joseph Dixon Crucible Co. have published an illustrated card showing a walking lead pencil bearing this motto from *Timon of Athens:* "My heart is ever at your service."

The new bridge which the Pennsylvania Railroad will build across the Hackensack River, near Jersey City, will be 1,000 feet in length, and have a double track at an elevation of thirty feet above tide water. The draw span will be of steel and the superstructure of wood. The cost will be about $150,000. The draw will not be put in until navigation is closed by ice.

Those who have received invitations to attend the dedication ceremonies of the World's Fair buildings have been formally notified of the change of date from the 12th to Friday, the 21st of October.

MANUFACTURES.

There is to be an oil-mill built at Whitewright, Tex.

An electric light plant is to be built at Gonzales, Tex.

A new silk factory is being erected at Westbury, N. Y.

The Cohoes Knitting Co. are putting in a new boiler.

Woodbury, N. J., is extending its system of water mains.

The Ladonia (Texas) oil-mill is nearing completion.

The street railway system of Laredo, Texas, is to be extended.

W. S. Smith & Co. will establish a machine shop at Eaton, Ga.

The Utica Tool Co., of New Hartford, N. Y., has been incorporated.

The P. & B. Nail Machine Co. has incorporated at St. Louis. Capital, $100 000.

The Citizens' General Electric Company, Louisville, Ky., has obtained its charter.

A large building is being erected in Potsdam, N. Y., for the manufacture of sugar of milk.

J. B. Boyle and others are building an iron foundry and machine shop at Westminster, Md.

James Clarke & Co. will erect new hoisting shears at their marine engineering works, Baltimore, Md.

A company has been formed, with a capital of $30,000, to make oil and japans at New Milford, Conn.

The Economy Feed-water Heater Co., of Guilford, N. H., has been organized, with capital of $50,000.

A company is erecting a cotton-seed oil-mill at Sherman, Tex., which will consume 400 tons of cotton-seed per day.

The Schickle, Harrison & Howard Co.'s Steel Foundry will be ready for work at St. Louis, in a few days, employing from 200 to 300 men.

The Track and Car Supply Company, of Chicago, has been chartered, capital stock, $275,000, by Joseph Schneider, J. Elliott and Charles S. Burton.

Oliver Brothers will likely buy the Rosena furnace, New Castle, Pa., and improve the plant materially. Their three years' lease expired recently.

The Board of Trade is negotiating for the erection of a 50-ton cotton-seed oil-mill at Camden, Ark. For information address the secretary of the board.

A dispatch from Lancaster, Pa., says that the Rohrerstown Rolling-mill, which has been idle for over a year, is being prepared for the resumption of work.

The Wausau Novelty Company, of Wausau, Wis., has been formed, with a capital stock of $30,000. The company will manufacture all kinds of toy furniture.

Wilbrod Baril and Zotique Corbeil have formed a partnership as manufacturers of doors, sashes, etc., under the name of Baril & Corbeil, at Montreal, Can.

The town of Parkhill, Canada, lately lost their Town Hall, and all their fire appliance. Have now secured a steamer and hose, and agitating a system of water-works.

The Standard Wheel Company has been incorporated at Louisville, Ky., to acquire patent rights of Albert Blackman for manufacturing scales; capital stock, $1,000,000.

Edouard Cavanagh and Joseph V. Mongeau have formed a partnership as manufacturers of washing machines, etc., under the name of the Cavanagh Mongeau Company, at Montreal, Can.

A corporation named the Neponset Steel Casting Company has been recently organized, and has purchased an extensive established plant at Neponset, Mass., which will soon be in operation.

The Torrey Roller Bushing Works has been organized at Bath, Me., for the purpose of operating a brass and iron foundry, and carrying on a general manufacturing business, with $60,000 capital.

The Ronald Steam Fire Engine Works, Brussels, Canada, are putting in some new iron-working tools, and will add a new addition to the factory. They are now manufacturing all kinds of fire appliances.

J. F. Rinker is endeavoring to organize a stock company to operate the foundry and machine shops of Wm. Shower, of Manchester, and Wm. Gilbert, of Westminster, Md., which propose to consolidate.

The J. A. & D. P. Cooper Co., recently incorporated, of Struthers, O., are increasing an old plant, adding a building 35x70 feet. They will need a planer, mortiser and tennoner. Carriage gearing is their product.

The Frank H. Clement Co., Rochester, N. Y., has issued a new and enlarged catalogue of woodworking machinery. The catalogue is finely illustrated, and very completely describes the machinery built by the company.

It is reported in Newark that an electric railroad from that city to Caldwell, *via* Bloomfield and Montclair, will soon be built by the New Jersey Traction Company, and that the project will meet with opposition in Montclair.

James S. Kirk & Co., of Chicago, have commenced the erection of a soap factory at Rhinelander, Wis. It will have a capacity of 14,000 boxes of soap per day, and will use 7,000,000 feet of lumber a year. There will be 1,200 men employed.

Geo. P. H. Rector, Frederic Speed, H. C. McCabe and Marye Dabney have incorporated the Hill City Street Railroad and Electricity Company, to erect electric light and power plants, etc., at Vicksburg, Miss. The capital stock is $100,000.

The Bickford Drill Company, of Cincinnati, Ohio, have issued some new pamphlets describing their new upright and radial drill presses, and their boring and turning-mills. These pamphlets will be sent to any address on application.

A St. J. Newberry, Chas. S. Powell and E. W. S. Neff have incorporated the Richmond Ice Company at Richmond, Ky., for the purpose of manufacturing ice, and with a capital stock of $25,000. This company has plant and is simply incorporating.

The rolling-mill at East Chicago, Ind., formerly run by the National Forge and Iron Company, which failed a year ago, will be put in operation by a new company. Mr. Frank B. Felt will be retained as general manager, and Mr. Robert Ross as superintendent.

Assemblyman John J. Dupuy and others are forming a corporation for the manufacture of baseballs and such other material as belongs to the national game. The company will have offices in New York, and Rutherford, N. J., with agencies in different parts of the country.

Heywood Bros. & Co are laying the foundation for a three-story brick building in Gardner, Mass. The box shop and a portion of the bleaching building will be incorporated into the new structure, which is to be used in part for the manufacture of wheels, springs and axles for baby carriages.

On Monday last work was commenced on the new Bessemer steel-mill at McKeesport, Pa., for the National Tube Works Company. The new building will adjoin the firm's blast furnace plant. The mill is expected to be completed and running by the first of next June, when it will employ from 500 to 1,000 men.

Messrs. Alph. Bayard, Arthur Yale, Ferdinand Bayard, Alfred Montreuil and G. V. Ducharme will apply for letters patent incorporating them under the name of the North America Mining Company, with a capital stock of $200,000. The principal place of business of the company is to be in Montreal, Can.

The United States Projectile Company, of Brooklyn, N. Y., are so driven with work that they have placed the order with the Berlin Iron Bridge Company, of East Berlin, Conn., for an addition 240 feet long to their present building. The addition will be entirely of iron, from the designs of the Berlin Company.

Daniel McDuff, of the new firm of Whitney & McDuff, who recently returned from a trip to Scotland, on which he went to purchase machinery for the prospective flax-thread-mill at Milibury, Mass., is now arranging for the reception of the new machinery, which he hopes to have in operation in about two months.

The National Sugar Refining Company has been incorporated at Trenton, N. J., with capital stock of $750,000. The company will commence business on $445,000. Benj. H. Howell, of New York, Nathaniel Tooker and John Hawley, of East Orange, are among the incorporators. The company will refine sugar and manufacture syrups at Jersey City.

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The new shop of the Carpenter Steel Company, at Reading, Pa., has been completed. The main building is 90x300 feet. The plant includes Corliss engines of 500 and 300 horse-power, 3 annealing furnaces, 18 converting furnaces, 22 heating furnaces, and 5 large double puddling furnaces. The company has large contracts from the government for Carpenter steel projectiles.

R. Dennis & Sons, London, Canada, are building a new brick factory, with a 40-foot frontage, on King street, by 60 deep, three stories high. Their old premises were found too small for their largely increased trade. They are going to put in a nickel-plating outfit and add new machinery, for the manufacture of iron work and iron fencing, in addition to their other lines of work.

Foundations have been laid at Mansfield, Pa., for the new cold-rolled steel plant of the Superior Cold-rolled Steel Company, which has just been chartered. The plant, which at first will consist of one hot and one cold set of rolls, will be in operation by November. The product will consist of steel of the quality requisite for keys, spoons, door-platings, etc. The company has a capital stock of $100,000. Henry J. Williams will be the active manager.

The consolidated firms, the Chase Elevator Co., of Fall River, and the Manton Windlass Co., of Mansfield, Mass., have taken the old wharf property of the Mechanics Machine Co., at Warren, Conn. The property, which was not in use for several years, consists of brick and stone buildings, which have been adapted to the building of elevators, windlasses, capstans and steering machinery. The main shop is 250 feet long, and contains a total floor space of 25,000 square feet.

The destruction by fire of the Whitney Woolen mills at South Royalston, Mass., threw nearly 200 hands out of work. It was feared that Col. Whitney, who is in feeble health and advanced in years, would not attempt to rebuild, but it is now reported that his son, George Whitney, and Mr. Phillips, of Fitchburg, who are associated in the business, are ready for an immediate re-building on a larger scale. The new factory will probably be made on the south side of the river, nearer the railroad track.

F. H. Cathcart & Co. is the name of a new firm which is opening a machine shop at Nos. 2925 and 2927 Ridge avenue, Philadelphia, Pa., for the manufacture of portable drilling and reaming machines, and other mechanical specialties, the invention of Mr. Cathcart. The latter has until recently been master machinist at the Pencoyd Iron Works, Pencoyd, Pa., under the general direction of its mechanical engineer, Mr. J. C. Christie, whose name is familiar to readers of the AMERICAN MACHINIST as an old correspondent.

The final organization of the Beman Automatic Oil Can Company (Lt'd) has been consummated. Several Meadville (Pa.) and Greenville (Pa.) gentlemen are associated with the new enterprise. The factory will be located in Meadville, Pa., and will soon be in operation. The can contains no pump, valves or other mechanical devices whatever, and is very simple, having for its special feature the filling of lamps automatically, without overflowing or spilling the oil. The company intend to manufacture all sizes of cans, from one to five gallons each.

Col. Albert A. Pope, president of the Pope Manufacturing Company, has bought a controlling interest in the Hartford Rubber Works at Parkville, Conn. He has also been chosen president of the company, and plans have already been made to extend the works. About 170 hands are employed, and the output of the establishment was nearly $500,000 last year. A large proportion of the present business consists of the manufacture of bicycle tires, pneumatic, cushion and solid. The change of control will not make any change in the business.

The new town of Elwood City, Shenango Valley, Pa., is to have a rolling-mill. The contract for the erection of four complete 22-inch mills has been awarded to the Leechburg Foundry and Machine Company by the Elwood Steel Company. These four mills will be divided into two trains of rolls, each train consisting of four stands of rolls. The mills will be equipped with all the latest improvements, and will be specially adapted for rolling heavy sheets. The same firm also has received a contract from the Cincinnati Rolling-mill Company, of Cincinnati, O., for the erection of two complete 22-inch sheet-mills of heavy pattern.

Machinists' Supplies and Iron.

NEW YORK, September 17, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15 to $15.50; No. 2, $14 to $14.50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $14.25 to $15 for No. 1 Foundry; $13.50 to $14 for No. 2; and $12.75 to $13.50 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20.25 for Eglington.

Antimony—The market is dull and irregular. We quote L. X., 10¾c. to 11c.; Cookson's, 11¾c. to 12c.; Hallett's, 10⅛c. to 10¼c.

Copper—The market is dull. Second-hand lots of Lake Copper have sold at 11¼c., but similar offers are scarce. The tendency is downward. Casting Copper is held at 10⅝c. to 11c.

Lead—The market is inactive. Local lead is offered at 4.15c., with buyers at 4.05c.

Lard Oil—Prime City is quoted at 62c. to 63c.; Western on spot at 61c.

Spelter—Some business is reported at 4.65c. for New York delivery; some brands may be bought at 4.60c.

Tin—The market has a weaker appearance, but the quotations are still 20.25c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Agents in every shop for machinists' fine tools, sliding calipers, etc. E.G.Smith, Columbia, Pa.

Wanted—Position as foreman boiler maker; reference furnished. Foreman, AM. MACHINIST.

Machinist and draftsman, 15 years' experience, wants pos. as foreman. A. B. C., AM. MACH.

Wanted—First-class mechanical draftsmen. Address Box 82, AMERICAN MACHINIST.

Wanted—Good machinists. Address, stating experience, The Goulds Mfg. Co., Seneca Falls, N. Y.

Draftsman wants position at once. Box 89, AMERICAN MACHINIST.

Wanted—Sit. by 1st-class mechanical draftsman, experienced designer. Box 88, AM. MACHINIST.

Wanted—Position by exp'd draftsman, N. Y. City; references furnished. Box 73, AM. MACHINIST.

Swedish tech. designer, age, 23, wants pos. in mach'y or shipbuilding works. Hugh, AM. MACH.

Mechanical draftsman desires change of position. Address B. S., 226 East 18th Street, New York.

Wanted—Position as superintendent or foreman of machine works, ten years experience, or shop on contract. Address Experience, AM. MACHINIST.

Wanted—Sit. by a prac. exp'd blacksmith, accustomed to all kinds of mach'y forg'g & tool dress'g; 3 years' exp. at tempering. Temperate, AM. MACH.

One mechanical draftsman wanted at once. None but strictly first class, with the best of references, need apply. Hydraulic Works, South Brooklyn.

An Eastern man, with long experience as machine designer, foreman and supt., desires similar position in or near Chicago. Box 85, AM. MACHINIST.

Wanted—Three planer hands, 3 lathe hands, and 2 floor hands, all first-class men. Sioux City Engine Works, Sioux City, Iowa.

Wanted—Two good machinists and two molders for dry and green sand molding. Apply or address to Kenney & Co., Scottdale, Pa.

Wanted—Foreman for large machine shop in New England; good opening for a first-class man. Address Box 90, AMERICAN MACHINIST.

A practical machinist, who has had 30 years of experience in the manufacture of all kinds of bolts, nuts and mach'y, and who has been superintendent in bolt works for a number of years, desires a similar position. Box 86, AMERICAN MACHINIST.

Wanted—An active, intelligent man for foreman of machine shop, N. Y. City, employing about 20 hands; must be strictly sober and thorough machinist, and experienced in marine work and general machinery. Address, with full particulars as to age, exp., and wages expected, Box 91, AM MACH.

Wanted Immediately—Mech. draftsmen with experience in mining, milling, smelting and concentrating plants. Also metallurgical engineer, with mech. knowledge and shop practice, to take charge as ass't eng.; also steam eng.; thoroughly posted in all classes of Corliss eng. designs, pumps and hoisting plants, to take charge as ass't. Send refs., exp., & salary wanted, to Fraser & Chalmers, Chicago, Ill.

Wanted—A man to take foremanship of the beam and wrought-iron department of an old-established architectural iron factory. Will have full charge of from 10 to 25 men. Must thoroughly understand iron stair work and structural work generally. Must be able to do his own shop detailing. Must be a man of executive ability, and competent to manage workmen economically. Young married man preferred. A permanent situation to a man who understands his business, and aims to excel. Address at once, giving age, experience, and amount of salary expected, Hetherington & Berner, 19-27 N. South Street, Indianapolis, Ind.

Bradley Hammers.

If you plate, draw, square, taper, swage, collar, spindle, or do any manner of die forging in iron or steel, a BRADLEY HAMMER will soon pay for itself, by what it will save over any other similar tool. Send for circulars.

BRADLEY & COMPANY, SYRACUSE, N. Y.

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Meet all requirements more fully and satisfactorily than any other of its competitors.

INVESTIGATION IS NOT COSTLY.
INVESTIGATION IS CONVINCING.

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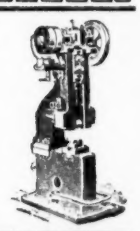

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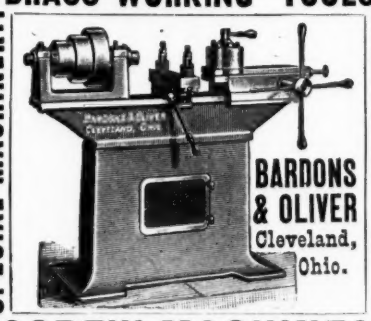
SPECIAL MACHINERY.



BARDONS & OLIVER Cleveland, Ohio.

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SCREW MACHINES.

WANTED

By an English Engineering Firm, a good Invention to work on Royalty. State full particulars to

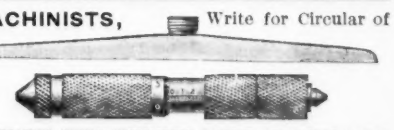
XX, THE INTERNATIONAL NEWS COMPANY,
5 BREAMS BUILDINGS,
Chancery Lane, London, England.

ENGINE RUNNERS' CATECHISM.

Telling how to Erect, Adjust and Run the principal Steam Engines in Use in the United States.

By ROBT. GRIMSHAW, M. E.
18mo, RED CLOTH, - - - $2.00.
John Wiley & Sons, - New York.

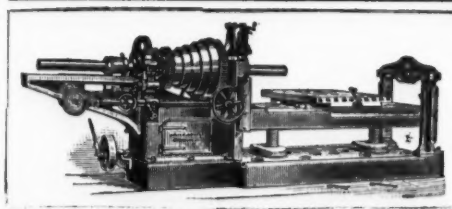
MACHINISTS, Write for Circular of



COMBINATION INSIDE MICROMETER CALIPER AND DEPTH GAUGE.
Agents wanted. J. T. SLOCOMB & CO., PROV., R. I.

FRISBIE FRICTION PULLEYS AND CLUTCHES.

THE D. FRISBIE CO.,
114 LIBERTY STREET, - NEW YORK.



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IMPROVED PATTERNS! LATE DESIGNS!

ASBESTOS CEMENT FELTING,

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Samples and Descriptive Price List Free by Mail.

We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

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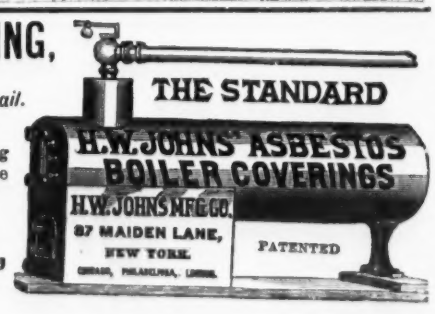
87 Maiden Lane, NEW YORK.



Wanted—By pattern maker, exp. and reliable, steady pos. and good class of work; would take pos. in tech. school as instructor in pattern making and fine wood-work. Robert Rockwell. Lynchburg, Va.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d-hd lathes & planers. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

Presses, Wire Form'g Mchy. Am. Tool Wks, Clev, O.

Bolt Cutter Heads a Spec'y. Am. Tool Wks., Clev., O.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Designs perfected; drawings, patterns and machines made to order. S. Carey, 17 Broadway, N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Design & superintendence of mach'y. Drawings, etc., made. Claud Mantle, 598 E. 134th St., N. Y.

For Sale—Dynamo and 8 16 C. P. Lamps, with sockets; new. 1214 Market Street, Meadville Pa.

Wanted—Hardware specialties to build. Send 25 cents for "Eureka Knife and Shears Sharpener." W. A. Smith & Co., 227 Eddy Street, Providence, R. I.

For Sale—Saunders' 12" Pipe Cutting and Threading Machine; cuts from 4 to 12". Used but little and as good as new. Address BOX 87, AMERICAN MACHINIST.

Bound volumes for 1891. We are now prepared to take orders. Price, $4.00 per volume; express charges payable by purchaser. Address AMERICAN MACHINIST, 203 Broadway, New York.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886, issue; must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

Special, experimental or other light machinery manufactured. Best equipped shop in the West for fine work. Manufacture one of the best hollow spindle bench lathes for the tool room or for manufacturing. Write us. Moseley & Co., Elgin, Ill.

For Sale—Stock in large iron manufacturing business, together with official position at fair salary, in a town of 40,000 inhabitants; good reasons for selling. Will take cash or good property. Address BOX 84, AMERICAN MACHINIST.

The undersigned have decided to confine themselves exclusively to the manufacture of their automatic engine, and offer their patterns and general jobbing trade for sale; jobbing trade amounted to $93,000 the last twelve months; a splendid chance for a good mechanic to start in with a permanent and good paying trade. Address J. H. McEwen Mfg. Co., Ridgway, Pa.

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IN STOCK.

LATHES.

All sizes of FLATHER.
" " BLAISDELL.
" " FIFIELD.
One each, 14"x6' and 24'x12' FITCHBURG.
One 78"x15' SELLERS.

PLANERS.

All sizes of WHITCOMB.
" " FLATHER.
One each, 30"x8' and 36"x8' PEASE.

DRILLS.

All sizes of PRENTICE.
" " BLAISDELL.
One 5' CINCINNATI RADIAL.
One 8" NEWTON SLOTTER.
All sizes of HENDEY and GOULD SHAPERS.

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HILL, CLARKE & CO.,

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CHICAGO BRANCH, 12 and 14 South Canal Street.

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10 ft. x 10 ft. x 16 ft. Planer.	1 Head.	
72 in. x 48 x 30 ft.	3 Heads.	
72 in. x 48 ft. x 21 ft.	do	3 Heads, Detrick & Harvey, new.
62 in. x 48 in. x 17 ft.	do	1 do
54 in. x 42 in. x 24½ ft.	do	2 do
46 in. x 33 in. x 30 ft.	do	2 do
42 in. x 42 in. x 16 ft.	do	2 do
29 in. x 36 in. x 12 ft.	do	1 do
36 in. x 36 in. x 8 ft.	do	Powell Al.
30 in. x 30 in. x 7 & 8 ft.	do	1 Head.
26 in. x 26 in. x 6 ft.	do	1 do
25 in. x 24 in. x 6 ft.	do	1 do
22 in. x 21 in. x 5 ft.	do	1 do

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42 in. x 17 ft. do Al do do
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22 in. x 12, 14, 16, 18 ft. Bed. New Engine do
28 in. x 12, 14, 16, 18 ft. do do do do
21 in. x 10, 12 ft. do do do do
20 in. x 7½ & 8 ft. do 2d Hand do do
18 in. x 6, 7 & 8 ft. do New & do do do
17 in. x 8 ft. do do do do
16 in. x 6 & 8 ft. do do do do do
15 in. x 6 & 8 ft. do do do do do
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9 & 12 in. Stroke Slotters.
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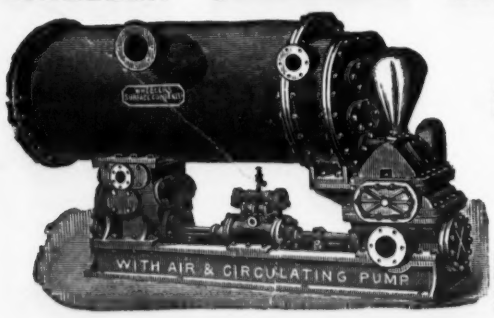

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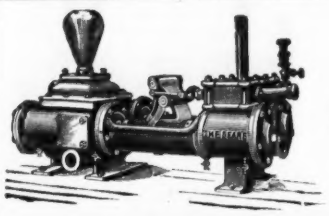

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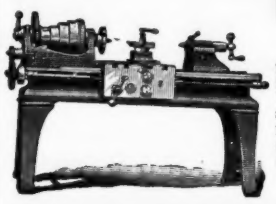

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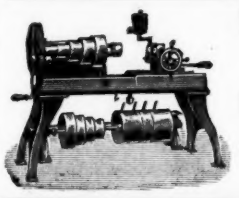

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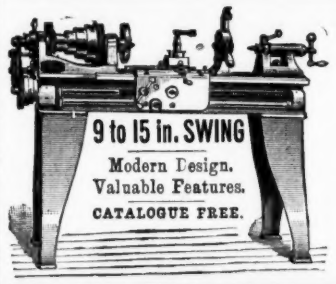

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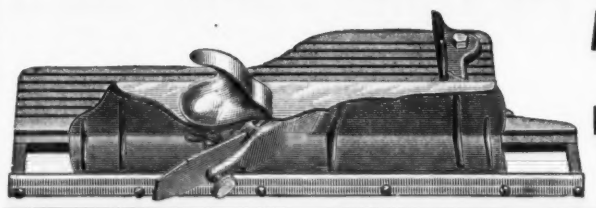

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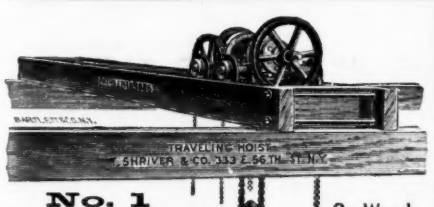

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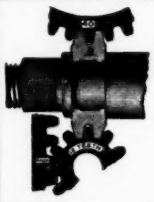

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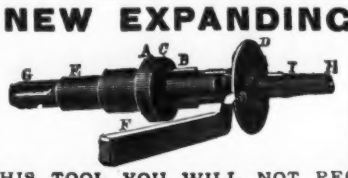

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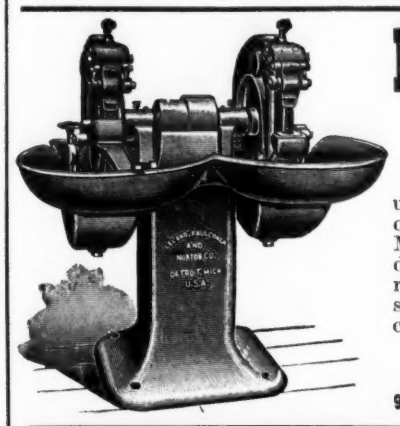

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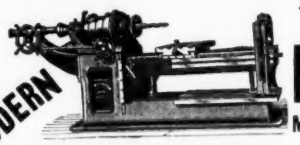

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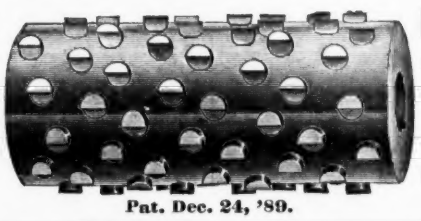

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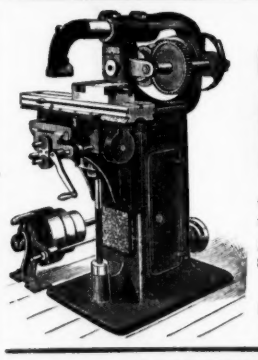

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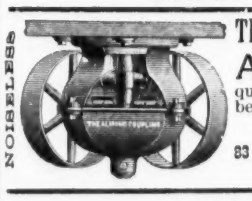

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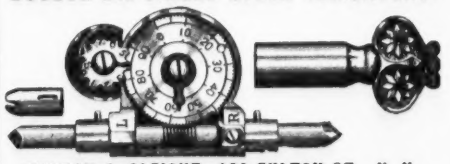

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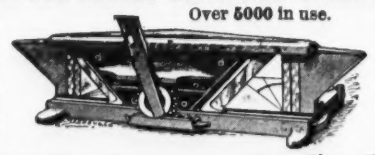

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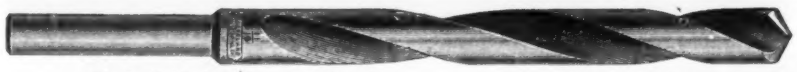

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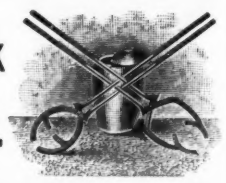

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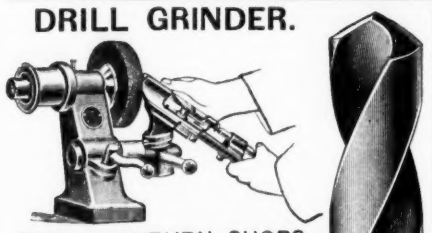

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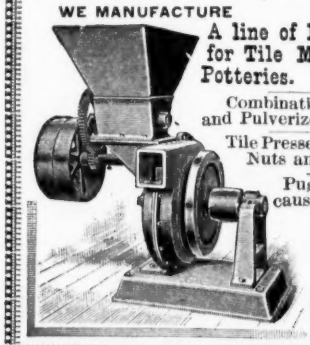

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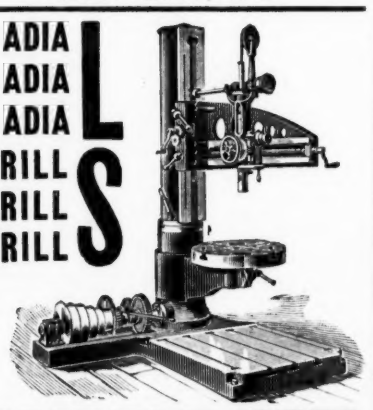

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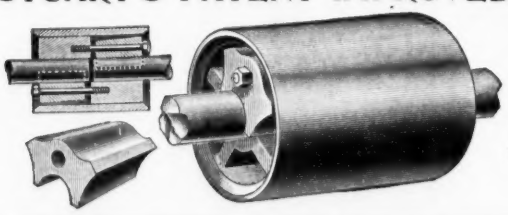

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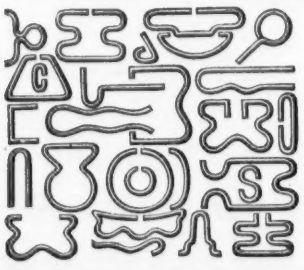

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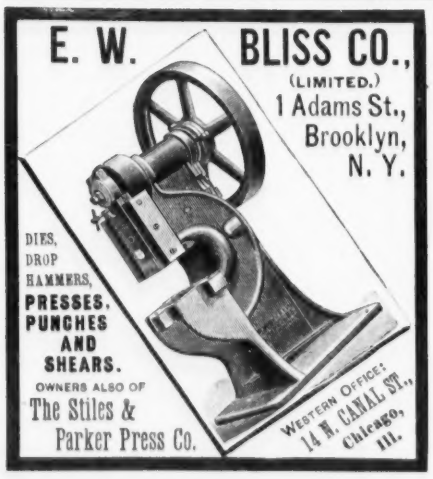

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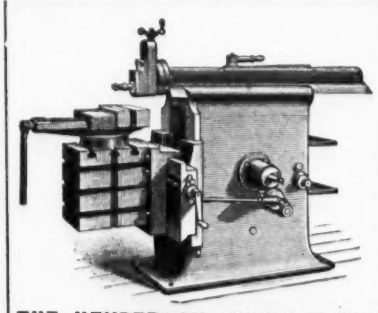

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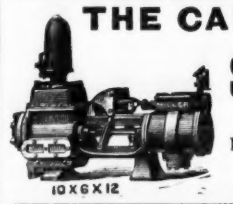

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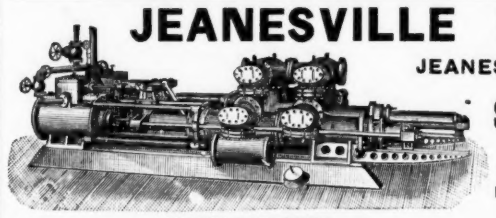

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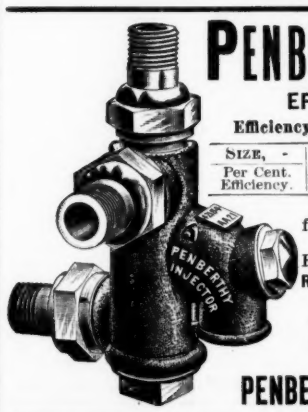

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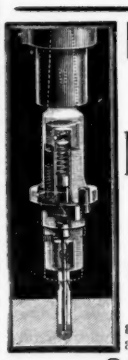

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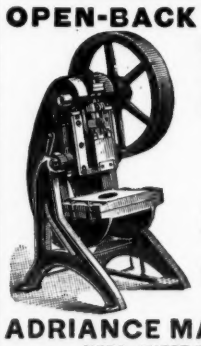

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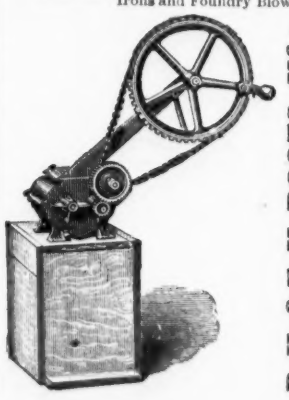

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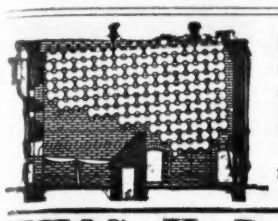

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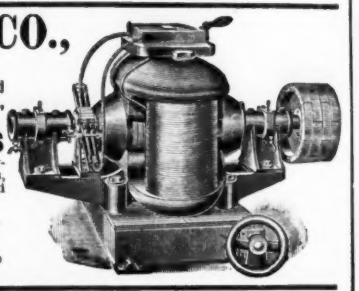

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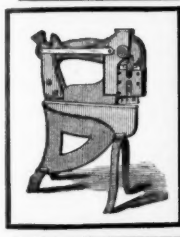

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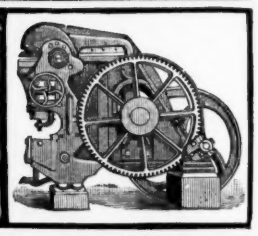

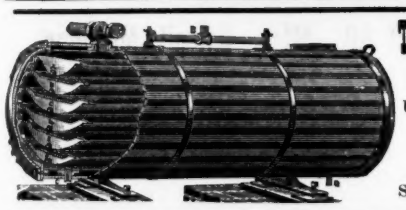

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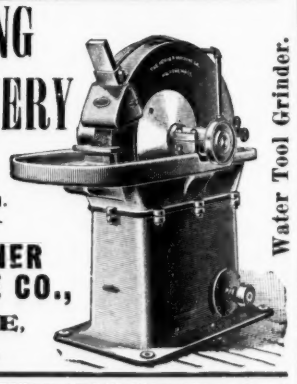

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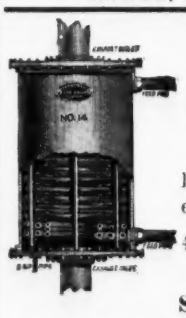

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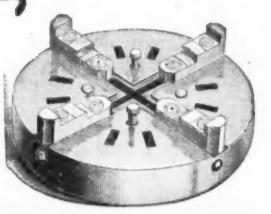

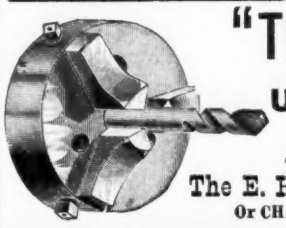

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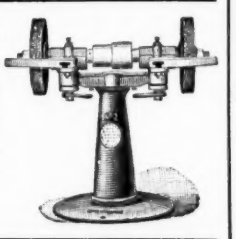

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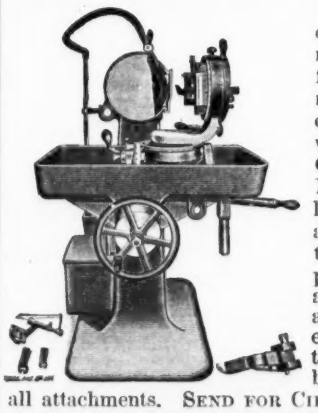

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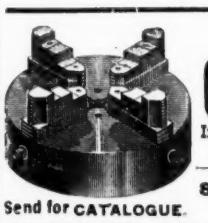

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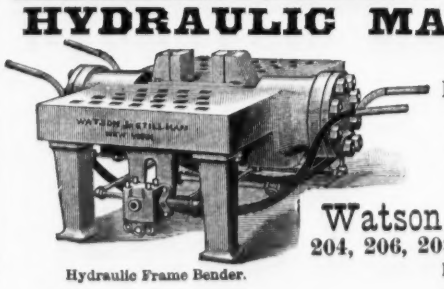

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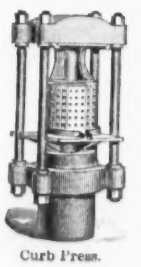

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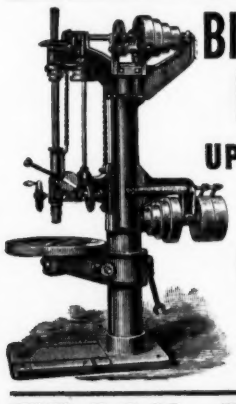

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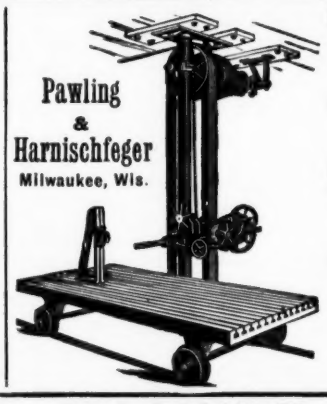

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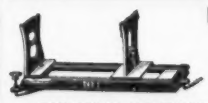

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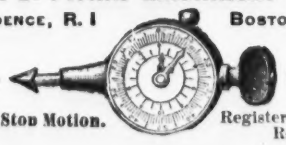

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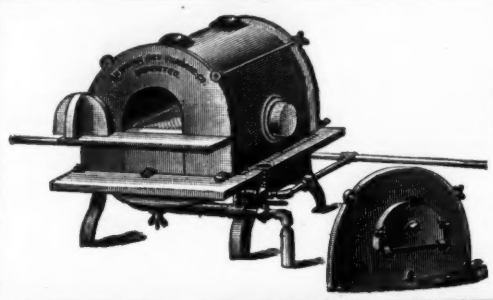

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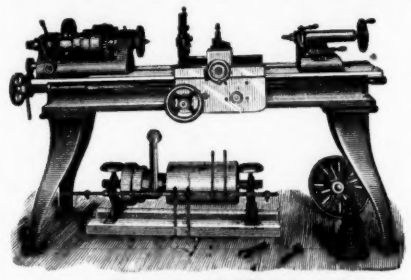

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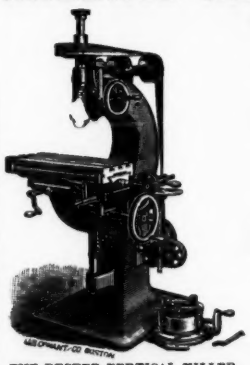

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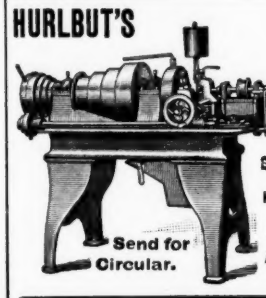

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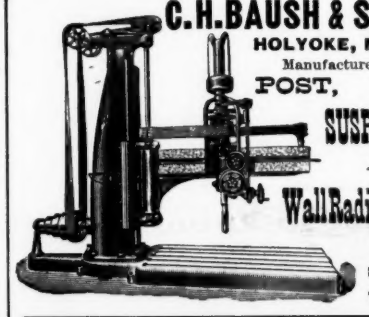

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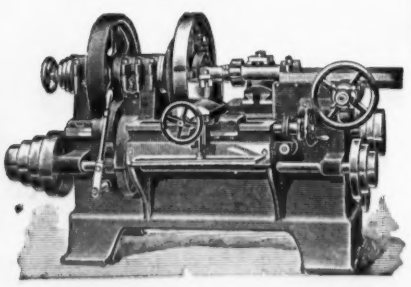

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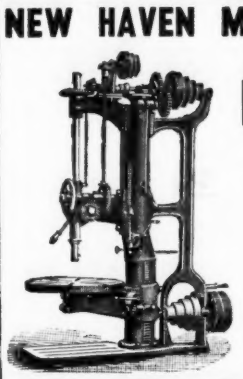

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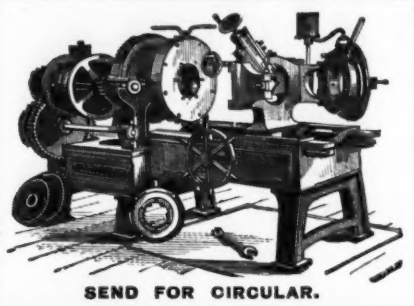

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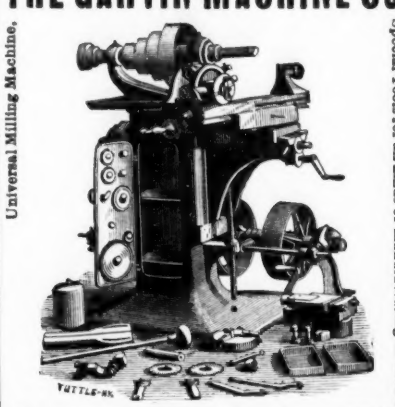

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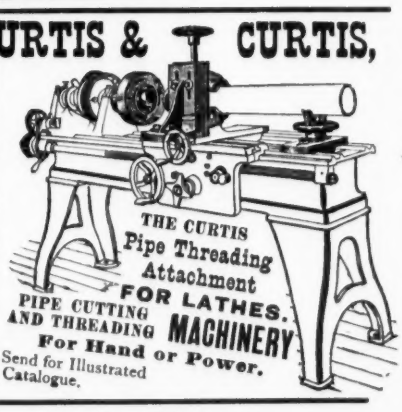

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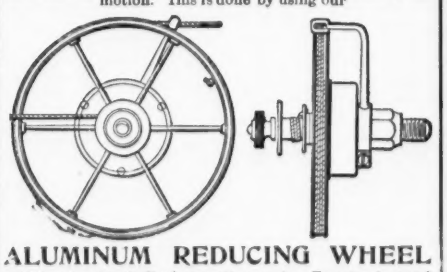

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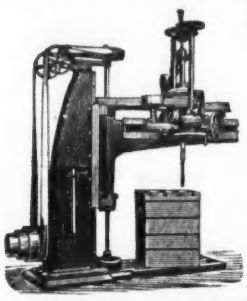

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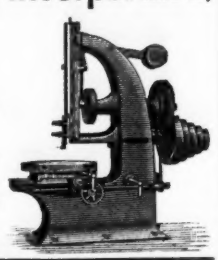

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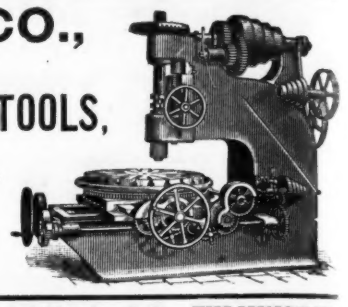

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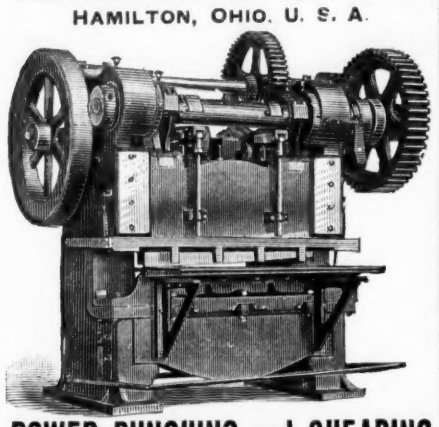

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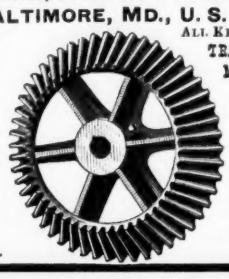

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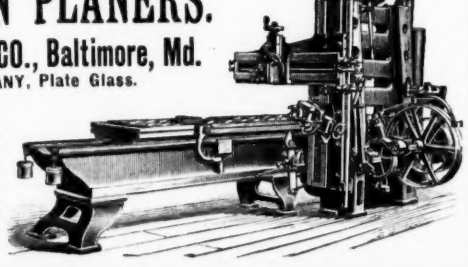

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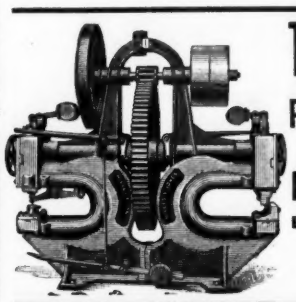

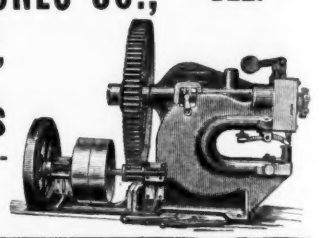

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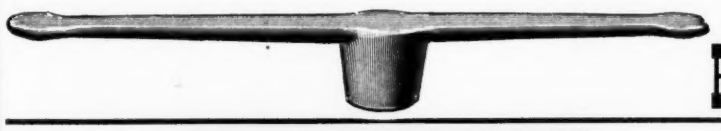

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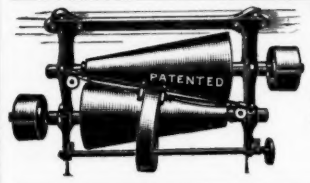

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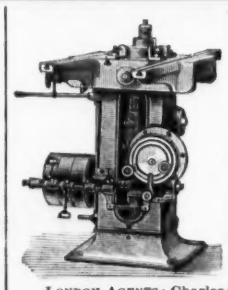

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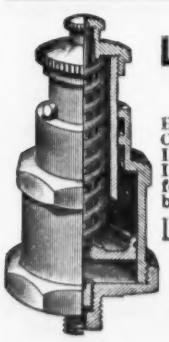

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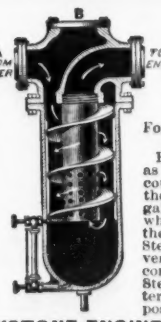

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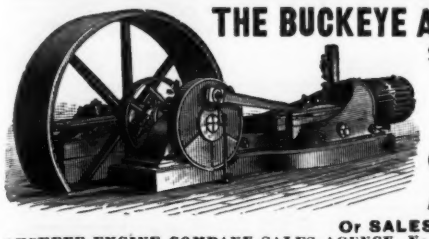

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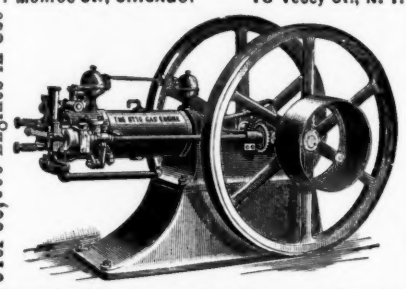

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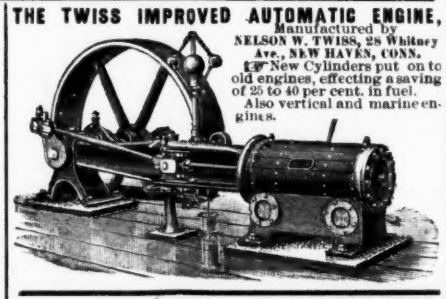

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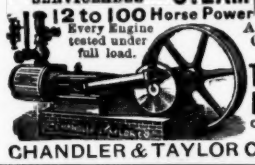

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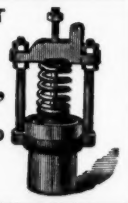

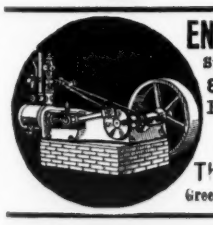

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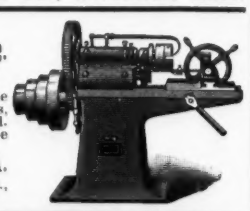

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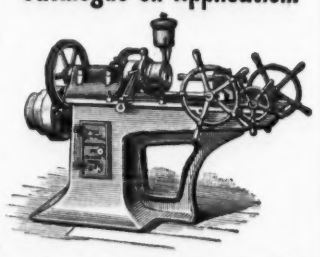

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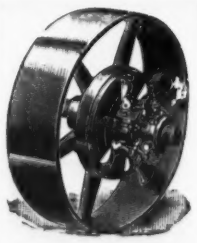

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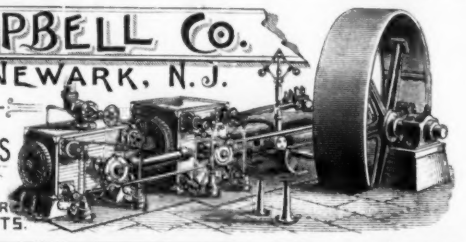

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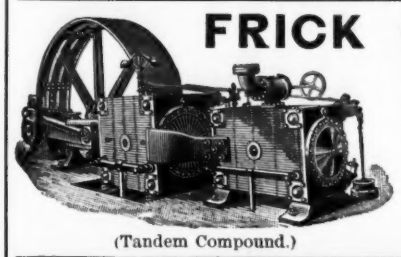

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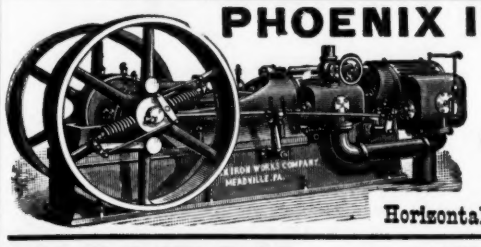

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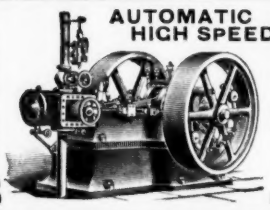

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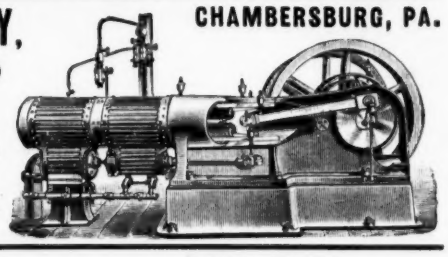

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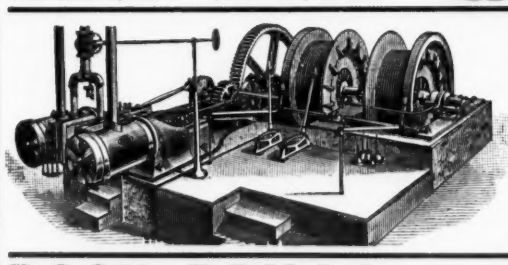

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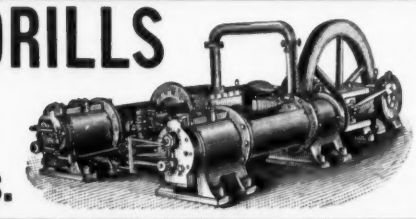

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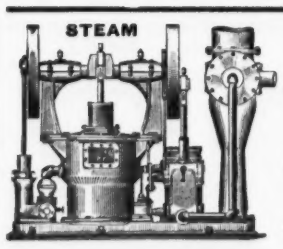

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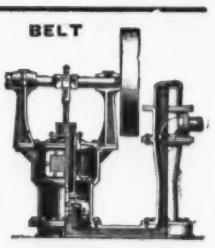

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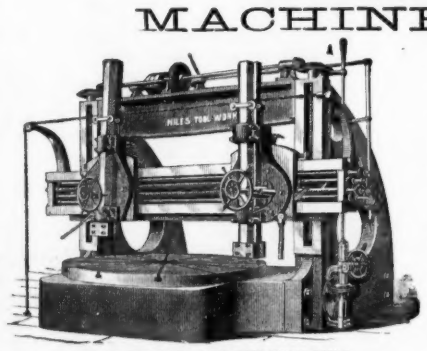

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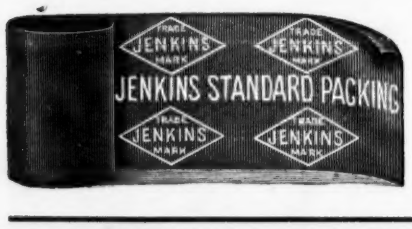

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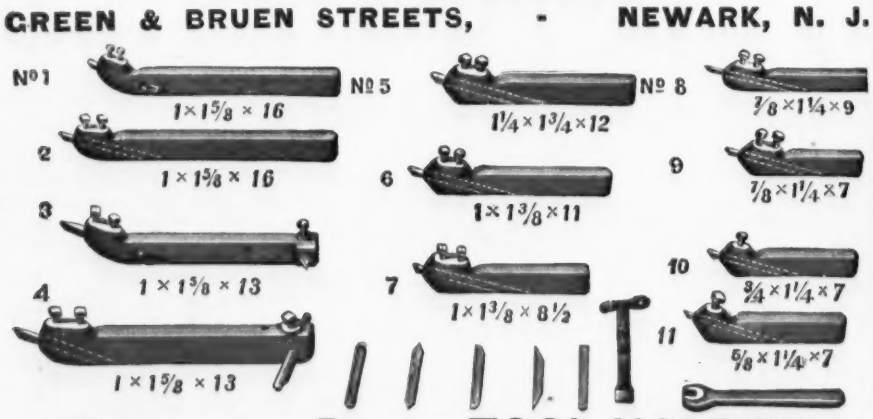

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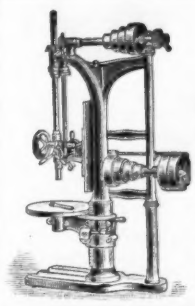

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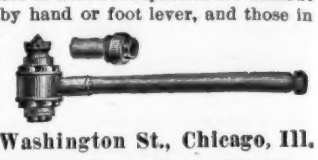

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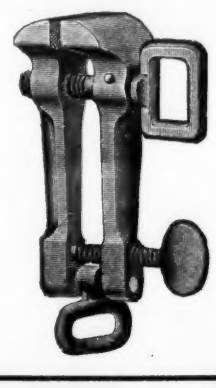

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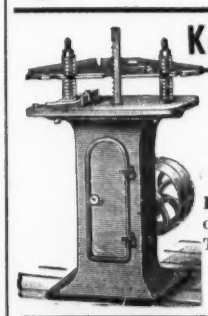

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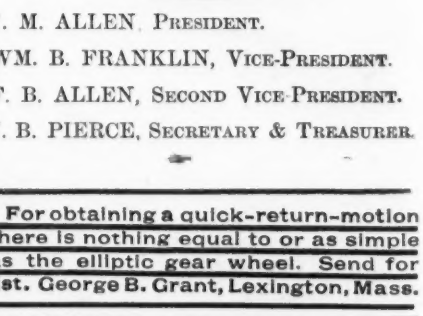

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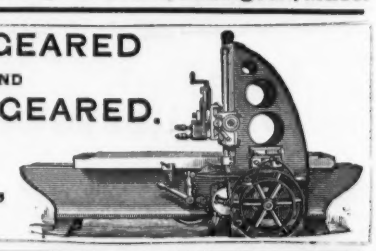

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